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NEWHALL (A. G.) & LEAR (B.). **Soil fumigation for fungus control with methyl bromide.**—*Phytopathology*, xxxviii, 1, pp. 38–43, 2 figs., 1948.

A tabulated account is given of experiments at Cornell University, Ithaca, New York, in the control of damping-off (*Pythium* and *Fusarium* spp.) and *Sclerotinia sclerotiorum* by soil fumigation [cf. *R.A.M.*, xxvii, p. 22] with methyl bromide and two commercial preparations, dowfume G and iscobrome, containing this compound. Several different methods of application were used, including liberation of the pure liquid (90 c.c.) in soil placed in 55-gal. covered metal drums, treatment of 1 and 2 cu. yd. compost piles under a gas-proof tarpaulin (1 lb. per cu. yd.), and injection of the commercial preparations at 1-ft. intervals in low piles or at shorter ones in flats of soil, followed by immediate sealing-in. Soil temperatures ranged from 48° to 75° F.

Substantial increases in germination were obtained, e.g., spinach from 2 to 62 and beets from 16 to 93 per cent. at soil temperatures of 48° and 60°, respectively, by methyl bromide in drums, cucumber from 25 to 80 per cent. by the same under gas-proof tarpaulin, and peas from 7 to 94 per cent. by dowfume G at the rate of 60 ml. in 12-in. centres about 5 in. deep in a pile. In three or four tests sclerotia of *S. sclerotiorum* were buried in soil undergoing treatment with either methyl bromide (11 ml. per cu. ft.) or dowfume G (50 ml.). When soaked for a few hours before fumigation, the sclerotia were totally destroyed even at 50° to 55°, but many of those left dry survived the treatment regardless of soil temperature.

Among the advantages of the methyl bromide preparations are facility of handling, speed of operation, and absence of phytocidal properties (such as pertain to chloropicrin), and growers willing to pay a small premium on this account are likely to find them very useful. It is believed that a 12-hour treatment with methyl bromide in a gas-proof drum, followed by a similar period of aeration, will amply suffice to prepare the soil for sowing, while further experiments may show that the dosages recorded here can safely be reduced. Since methyl bromide is practically odourless and dangerous to man, the operator should always provide for plenty of ventilation.

POUND (G. S.). **Variability in Phoma lingam.**—*J. agric. Res.*, lxxv, 4, pp. 113–133, 5 figs., 1947.

A full account is given of a study of a strain of *Phoma lingam* occurring regularly as a minor pathogen causing leaf spot and stalk rot of seed plants of cabbage, Chinese cabbage (*Brassica pekinensis*), swede, and turnip in the Puget Sound section of Washington State. Only traces of infection in the form of scattered leaf lesions and occasional stalk rots were observed in cabbage fields; typical blackleg [canker] was not found. On Chinese cabbage infection was more severe than on the other hosts; lesions were commonly present on the leaf petioles, spreading to the axils, and thence to the stem. The flower-heads emerging from the leaf axils became infected, with resultant severe blighting of the florets. Numerous lesions were present

at and above ground-level, causing the stems to break over. Abundant sporulation occurred on the surface of the lesions. No natural infection of seed pods was noted.

Pathogenicity studies were made with the following monoconidial isolates of *Phoma* grouped according to their characteristics on potato-dextrose agar. Group 1. A. Slow-growing isolates from a Wisconsin culture (W 11); B. slow-growing isolates from a cabbage leaf lesion from Oregon, producing no sclerotium-like bodies (S 1); C. slow-growing Oregon isolates producing sclerotium-like bodies (S 39). Group 2. A. Fast-growing isolates from Wisconsin culture and blackleg material and cultures from blackleg material from New York and Iowa (W 43, NY 1, Iowa–11, and W 307); B. fast-growing Oregon isolates. Group 3. Puget Sound isolates from Chinese cabbage (PS 40 and PS 200), and those from a Californian culture (C 1).

When seeds of the aforementioned hosts and radish, kale, and Brussels sprouts were soaked in a spore suspension for 48 hours before planting, the seedlings developed cotyledonary lesions and severe damping-off within two weeks. The cotyledonary lesions caused by group 3 isolates appeared three to five days earlier than those caused by the others and were of a noticeably different type; mostly they were marginal and chocolate-brown from the start and enlarged slowly; the pycnidia produced on the lesions were few, rather large, and brown rather than black. The cotyledonary lesions produced by the remaining isolates appeared as shrunken, dark green areas which rapidly enlarged and became thickly studded with pycnidia before the lesion surfaces darkened.

When older plants were inoculated on leaves of Brussels sprouts the Oregon and Puget Sound isolates caused black, necrotic flecks surrounded by a conspicuous chlorotic halo at the infection sites. Isolates W 11, Iowa–11, W 43, and NY 1, on the other hand, caused complete blighting of the leaves, while the lesions did not develop any conspicuous halo. On stems of cabbage, cauliflower, and Brussels sprouts the isolates all produced typical blackleg.

On leaves of cabbage, cauliflower, and broccoli the symptoms produced by PS 40 and a variant of W 11 were distinct from all others. Numerous black, necrotic flecks developed in six to ten days. They enlarged very little before the leaves became chlorotic and abscissed. Sporulation was scant or absent. Occasionally a few lesions enlarged and developed light centres and pycnidia as in nature. Several weeks elapsed before this stage was reached, and if the spore load used was not very light, the leaves fell off before it was reached. Isolates W 11, W 11 M 1, W 11 M 2, NY 1, Iowa–11, W 43, and W 307 all produced circular lesions covered with pycnidia; they rapidly enlarged and coalesced with complete necrosis.

On turnip leaves all the isolates produced only pin-point, necrotic flecks. On swede they all produced extensive infection, with brown, necrotic lesions up to 20 mm. in diameter; PS 40 and C 1 were less virulent than the other isolates. When swede plants in mid-bloom were sprayed with spore suspensions of S 1, S 26, S 39, W 11, NY 1, Iowa–11, and PS 40 and watered with a hose, the mature pods showed lesions typical of those due to *P. lingam*.

Cultural studies demonstrated that the Puget Sound isolates differed from those from typical blackleg lesions in the production of a water-soluble yellow to brown pigment in the medium and mycelium, and in their coarser mycelium. They also produced symptoms differing in type and virulence from those of typical blackleg. It is concluded that the Puget Sound strain of *Phoma* falls within the range of variability in morphology, physiology, and pathogenicity of *P. lingam* and is a variant of it.

Cox (R. S.). **Stem anthracnose of Lima Bean and its control.**—Abs. in *Phytopathology*, xxxviii, 1, p. 7, 1948.

The most conspicuous symptoms of stem anthracnose (*Colletotrichum truncatum*),

the agent of heavy losses among Lima beans [*Phaseolus lunatus*: *R.A.M.*, xiv, p. 416] in North Carolina, are brick-red lesions on the pods, stems, and leaves, but the inflorescence is also commonly involved, often resulting in blossom-drop and death of immature pods. The typically grey spore mass occasionally gives rise to a pink sector, the colour of which persists indefinitely in culture. Evidence of transmission of the fungus through the seed was obtained in experiments. Of 16 varieties tested, only Jackson Wonder showed some tolerance, all the others being highly susceptible. In weekly fungicidal tests on replicated plots of Henderson Bush, phygon spray (1·5–100) gave the best control on the foliage, stems, and pods, increasing the yield from 1,711 lb. per acre on the untreated areas to 5,847 lb., the corresponding figure for fermate (3–100) being 4,803 lb. Of five dusts tested, only 5 per cent. phygon and 6 per cent. dithane Z–78 significantly controlled the disease. Phygon (spray or dust) caused slight foliar chlorosis and blossom-drop.

Hendrix (J. W.), Du Charme (E. P.), & Murakishi (H.). **Pathogenicity of single spore isolates of the Fusarium wilt organisms of Muskmelon and Watermelon.** —Abs. in *Phytopathology*, xxxviii, 1, p. 13, 1948.

The wilts of watermelon and muskmelon have hitherto been attributed to forms 1 and 2 of *Fusarium bulbigenum* var. *niveum*, respectively [cf. *R.A.M.*, xiii, p. 560; xxvi, pp. 119, 218, *et passim*], with no exceptions to the strict rule of host-pathogen specificity. However, further research by the writers showed that some isolates from wilted muskmelon plants cause severe pre-emergence killing and wilting of watermelon seedlings in the greenhouse. Conversely, some isolates from watermelon are parasitic on muskmelon. For instance, certain monospore isolates from muskmelon caused up to 40 per cent. reduction in stand of watermelon, and similar losses occurred when muskmelon seedlings were grown in soil infested with isolates from wilted watermelons. On the original hosts different isolates caused from 0 to 100 per cent. mortality. Generally speaking, the virulence of a given isolate was greater on its original host than on the second one, but several watermelon isolates caused heavier reductions in muskmelon stands than in those of their own host.

Gries (G. A.). **Physiology of Fusarium foot rot of Squash.**—*Bull. Conn. agric. Exp. Sta.* 500, 20 pp., 2 figs., 3 graphs, 1946.

Squash foot rot (*Fusarium* [*Hypomyces*] *solani* f. *cucurbitae*) [*R.A.M.*, xxi, p. 224; xxvi, p. 46] was first described from South Africa in 1932 [ibid., xii, p. 197] and has since been reported from California [*Phytopathology*, xxviii, p. 19] and the north-eastern United States, notably Connecticut. The leaves wilt and the whole aerial portion of the plant collapses within a few days. The basal part of the stem becomes soft and mushy and later dark brown. The fruiting mycelium frequently appears on the rotted regions of the stem and on the surrounding soil as a whitish or pink mass. The extent of the stem rot varies with the soil moisture content and atmospheric humidity. The root system is not usually affected. When seedlings are attacked the vascular system is frequently destroyed. The symptoms appear on the fruit as a soft, water-soaked lesion which on drying out becomes a white to grey, zonate, radiating area eventually coalescing with adjoining regions until the whole fruit surface is covered. The inside of the fruit rots and desiccates until only the dry shell remains. In California the disease attacks vegetable marrow, pumpkin, squash, *Cucurbita moschata*, and in particular the Italian Zucchini squash. In Connecticut it is almost entirely limited to the marrow and its hybrids.

The fungus is carried as spores on the seed surface, as mycelium in the testa, or occasionally as sporulating mycelium in the embryo. Once established in the soil

from infected seedlings or diseased non-viable seeds the fungus is spread in the field mechanically through cultivation, by growing on organic debris in the soil, by surface water, or by insects. The seeds become contaminated either by mycelial penetration through the rotted fruit or during fermentation. Immersion in hot water for 15 minutes at 55° C. and steeping for 15 minutes in 1 : 1,000 mercuric chloride, followed by thorough rinsing in water, respectively controlled seed coat and surface infection, although the former treatment caused an appreciable reduction in germination. After two years' storage the fungus apparently dies out of the seed and no diseased seedlings are produced.

Experiments to determine the effect of time and manner of inoculation in the field were made by injecting spores into the pedicel, the basal fleshy portion, and seed cavity of the fruit at five-day intervals between flowering and maturity. The seeds, after fermenting, were stored during the winter and planted in disease-free soil. The percentage of disease in the seeds decreased with their age and with the distance between the point of inoculation and the seed cavity. Inoculations made 26 to 30 days after blooming in the pedicel, fruit base, and seed cavity gave an average of 11, 33, and 82·5 per cent. disease, respectively. In nature inoculation of the fruit occurs through insect punctures and mechanical injuries. Scratches made to label fruits proved to be sources of entry for the fungus.

Although the foot rot fungus is capable of overwintering in Connecticut soils this does not seriously affect squash production, as the fungus does not remain viable for more than two winters at the most. Experiments with various soil mixtures indicated that it was relatively short-lived in organically amended soil. In a preliminary experiment carried out in 1942 and again in 1943 soil amendments of sulphur and potassium chloride delayed the development of disease symptoms in the fields by periods of up to two weeks, while calcium hydroxide appeared to encourage it. The amount of disease in sand cultures was always greatest when the calcium : potassium ratio was very high. It appears, therefore, that the development of squash foot rot is dependent on the nutrition of the host plant with calcium or potassium, or both. On the basis of the data potassium reduces the effect of calcium in encouraging the disease.

Whitaker (T. W.) & Pryor (D. E.). **Correlated resistance of leaves, cotyledons, and stems of Cucumis melo L. to Cantaloupe powdery mildew (Erysiphe cichoracearum DC).**—*Phytopathology*, xxxvii, 12, pp. 865–867, 1947.

At the United States Horticultural Field Station, La Jolla, California, the authors investigated the differential susceptibility to powdery mildew (*Erysiphe cichoracearum*) of various organs of the same cantaloupe plant [*R.A.M.*, xxii, p. 193] in a total of 859 from eight separate F_3 families. In greenhouse experiments the correlation co-efficients for infection between leaves and stems, leaves and cotyledons, and cotyledons and stems were computed at 0·818, 0·838, and 0·866, respectively, all significant at the 1 per cent. level and indicating a close association between the intensity of the symptoms—mild, moderate, or severe—on these organs. Field observations of natural infection generally tended to corroborate the results of the greenhouse tests, at any rate as regards very susceptible varieties, which appeared to sustain equal damage with the leaves and stems. Progenies with a fairly high level of resistance, however, commonly produce plants bearing mildew colonies solely on the leaves, possibly because the stems escaped infection or were attacked only slightly or at a later date than the foliage.

These experiments yielded no evidence for the existence of more than one biotype of *E. cichoracearum*, or for any variation in susceptibility to the pathogen between different organs of the same plant. The genes for susceptibility seem to operate uniformly throughout the aerial system of the cantaloupe.

Behr (L.). **Über einige Ergebnisse histologischer Untersuchungen an krätzekranken Gurken (Cucumis sativus L.). (Vorläufige Mitteilung.)** [On some results of histological studies on gummosis-diseased cucumbers (*Cucumis sativus* L.). (Preliminary note.)]—*NachrBl. dtsch. PflSchDienst*, N.F., i, 7–8, pp. 121–122, 1947.

In Germany outdoor cucumbers sustain heavier damage from gummosis (*Cladosporium cucumerinum*) [*R.A.M.*, xxvi, p. 375] than those grown under glass. The author's studies on the histology of the disease, not yet described in the relevant literature, were carried out at the Aschersleben [Saxony] branch of the Biological Institute [ibid., xx, p. 510].

Inoculation experiments on the petioles and fruits of a susceptible variety showed that the pathogen does not depend on the stomata for ingress to the young tissues, which are reached by the germ-tube penetrating the epidermis at the line of junction of the cells. Older organs, on the other hand, are more refractory, succumbing only to invasion through wounds, e.g., those inflicted by mechanical breakage of the spines covering the epidermis. The incubation period of the fungus was four days.

Subsequent observations were made almost entirely on the fruits, in which the parasite was confined to the immediate vicinity (radius of 10 mm.) of the externally perceptible pustules and to the subepidermal layers. Transverse sections not directly through a pustule revealed to the naked eye discoloured cell complexes, which were found to consist of brown vascular bundle strands, traversed by intercellular hyphae and interrupted in their vertical course by necrotic foci of infection. These cavities, arising through cytolysis, were often partially or wholly filled with a pale yellow, resinous mass enveloping the hyphae and conidiophores. The typical olive-green, velvety lesions on the epidermis, ruptured by tension from the steadily accumulating contents of the underlying cavities, are formed by the joint action of the mycelium and the gummous droplets. A mucous, later hardening, transparent secretion from the fruit parenchyma was shown by microchemical tests to be identical with the resinous content of the subepidermal cavities and the gummous droplets of the pustules. These metabolic products of reaction to the gummosis pathogen stain deep purple in 10 per cent. copper sulphate and 10 per cent. potassium hydroxide and were identified on this basis as wound gum. Further, *C. cucumerinum* induces the formation, both in the fruits and in the petioles and shoot axes, of deep brown reaction products which intensively discolour the cell walls and the plasma in the immediate vicinity of the sites of invasion. The chemical identity of these substances has not yet been established.

Padmanabhan (S. Y.). **Occurrence of Myrothecium roridum Tode ex Fries on Cowpea in India.**—*Curr. Sci.*, xvii, 2, pp. 56–57, 1948.

The fungus responsible for a leaf spot of cowpeas in Bengal in 1945 and 1946 was determined by E. W. Mason as *Myrothecium roridum* [*R.A.M.*, xxvi, p. 492], the morphology of which is briefly described. The spots are minute at first, brown with a raised, somewhat pinkish-violet margin and a depressed, brown, translucent centre; later they become zonate.

Capoor (S. P.) & Varma (P. M.). **Enation mosaic of Dolichos lablab, a new virus disease.**—*Curr. Sci.*, xvii, 2, pp. 57–58, 3 figs., 1948.

In August 1939, *Dolichos lablab* at Poona was affected by foliar mosaic and chlorotic streaks, which recurred on the Agricultural College Farm in 1940, 1941, and 1942 but has been observed only occasionally since. The inoculation of young leaves under controlled conditions with sap expressed from diseased plants was followed in about 20 days by the first symptoms of mosaic, which assumed a severe form and were accompanied by chlorotic streaks in the subsequent growth. The

size of the leaf blade was markedly reduced by the suppression of growth in the interveinal areas and enations were produced on the under side of the leaves. Attempts at transmission of the virus by means of several insects were unsuccessful.

The dilution end point of the virus in crude sap lies between 5×10^{-6} and 3×10^{-6}. It can resist ten minutes' heating at 90° C. but is inactivated at 95°. Its virulence was not impaired by six years' storage in the laboratory. The virus from *D. lablab* can infect a large number of other legumes, including beans (*Phaseolus vulgaris*), and White Burley tobacco. The former host reacts by a lethal systemic necrosis and the latter by primary lesions in the form of thin, white rings of necrotic tissue enclosing green areas and a secondary systemic mottling which develops about 65 days after inoculation.

The *D. lablab* virus, although closely resembling that of tobacco mosaic in its physical properties, differs appreciably from the latter in its host range and in the type of symptoms induced in tobacco itself. However, cross-immunity tests performed with the two viruses on tobacco indicated that neither confers reciprocal protection. It is concluded, therefore, that no relationship exists between them, while the only affinities of the *D. lablab* virus and those of other legumes are with bean viruses 4 and 4 A [southern bean mosaic virus: *R.A.M.*, xxiii, p. 203] and pea streak virus [ibid., xvii, p. 721] in respect of the thermal inactivation and dilution end points, respectively. '*Dolichos* enation mosaic' is the name proposed for the new disease.

BRANAS (J.). **A propos de récentes recherches sur les soufres.** [On recent researches on sulphurs.]—*Progr. agric. vitic.*, cxxvii, 22–23, pp. 419–422, 1947.

The author quotes his own recent experiments [*R.A.M.*, xxv, p. 432] on the emission of sulphur vapour from sulphur-containing powders and the improved methods of Fouretier and Boullé (*Ann. agron.*, p. 447, 1947) showing that at 44·4° [C.] the volume of vapour emitted from the surface of a sulphur-containing powder (sprinkled on a glass slide) remains constant when the density of the powder is 0·25 mg. or more per sq. cm. Fouretier and Boullé also show that (1) for the same kind of sulphur the rate of evaporation varies little between densities of 0·1 and 0·25 mg. per sq. cm., and that (2) for different kinds of sulphur having the same superficial densities the rate of evaporation is much about the same when the density is less than 0·05 or more than 0·4 mg. per sq. cm. and varies little when the density is between these. Nevertheless these workers confirm Branas's earlier observation that trituated sulphur evaporates more slowly than other kinds. However, it has to be admitted that the amount of sulphur vapour emitted by a powder containing sulphur depends on the sulphur and not on the inert matter in it. This being so, it is difficult to maintain that a product containing only 30 per cent. free sulphur can act with the efficacy of pure sulphur, though this is what Fouretier and Boullé try to demonstrate. They claim that vines are as a rule given excessive quantities of sulphur, the lowest density of flowers of sulphur used being 47·5 kg. per ha., at which rate the superficial density on the leaves would be 0·5 mg. per sq. cm. But these figures assume that the vine surface covered per ha. is exactly one ha. Figures produced by Ravaz and Gèze in 1918 show that in one Aramon vine the total area of the green organs, including both leaf surfaces, amounted to 18·65 ha. per ha., so that a sulphur application at the rate of 47·5 kg. per ha. would be equivalent to 0·025 mg. per sq. cm. or only one-tenth of the density limit. Even if only one leaf surface were treated the application would amount to only 0·05 mg. per sq. cm.

That vines do not receive excessive applications of sulphur appears to be confirmed by the presence of *Oidium* [*Uncinula necator*: *R.A.M.*, xxvi, p. 228] in many vineyards treated with sulphur and by the observed inadequacy of some treatments made at the usual rate.

Săvulescu (T.). **Mana Viţei de Vie studiu monografico.** [A monographic study on Vine downy mildew.]—213 pp., 10 pl. (5 col.), 35 figs., 3 diags., 17 graphs, Imprimeria Nationala, Bucarest, 1941. [Received April, 1948.]

This important treatise on vine downy mildew (*Plasmopara viticola*) deals exhaustively with the history, symptomatology, geographical distribution, taxonomy, morphology, and biology of the causal organism, varietal reactions, control measures, and forecasting stations, with special reference to the occurrence of the disease in Rumania [*R.A.M.*, xxiii, p. 142; xxv, p. 487]. An 11-page bibliography is appended.

Kozlowska (A[niela]). **The changes caused by ammonium molybdate and virus diseases of plants.**—*Bull. Acad. polon. Sci.*, Ser. B (1), *1946*, pp. 109–165, 1 graph, 1947.

Studies carried out in Warsaw from 1938 to 1944 demonstrated that a correlation exists between susceptibility of plants to virus diseases and reaction to molybdenum. The more susceptible the host (e.g., chilli pepper, tobacco), the stronger was its reaction to watering with ammonium molybdate solution. Rye and *Solanum acaule*, a wild Mexican species, which are immune from virus diseases, failed to react to molybdenum. Young tobacco plants given 4 gm. molybdate became resistant to mosaic.

From the various plants watered with ammonium molybdate a simplex lipoprotein was isolated which gave in solution a yellowish-brown, strongly opalescent liquid; it was precipitated by all the reagents precipitating proteins; it showed positive xanthoproteic, Millon, Adamkiewicz, and Voisenett reactions, but not the biuret; it resisted the action of digestive enzymes and strong acids and alkalis; and its isoelectic point was pH 4 to 4·2. In the purified lipoprotein the lipoid made 50 per cent. of its mass and surrounded the protein particles, this explaining its resistance to digestive enzymes and strong acids and alkalis.

Using the methods of Bawden and Pirie, the author obtained crystallized tobacco mosaic virus and purified potato virus X from several plant species inoculated in an isolated greenhouse with pure line viruses obtained from K. M. Smith. From these she obtained specific antisera [*R.A.M.*, xxvii, p. 160]. The antiserum of virus X gave the precipitin reaction with fresh sap from *Phlox* infected with potato virus X and from healthy President potato plants watered with molybdate at the rate of 5 gm. per pot. Precipitation with antiserum X of the lipoprotein from plants watered with ammonium molybdate weakened after some days, though the complement fixation reaction remained permanent. The characteristic serological reaction appeared only in the sap of plants watered with ammonium molybdate. When watering ceased, the leaves developing later did not break the haemolysis in complement fixation reaction; they were also susceptible to tobacco mosaic and potato virus X, though the plants that contained any considerable percentage of lipoproteins were immune.

The protein, having the properties of the lipoprotein, obtained from the tubers of potato plants watered with ammonium molybdate showed different serological properties from those of the lipoproteins from the green parts. It gave a quite distinct precipitin reaction with both antiserum virus X and antiserum tobacco mosaic. Rabbits immunized with this lipoprotein produced antibodies which gave the serological reaction with tobacco mosaic and virus X.

Nattrass (R. M.). **Annual Report of the Senior Plant Pathologist, 1946.**—*Rep. Dep. Agric. Kenya, 1946*, pp. 149–152, 1948.

In this report [cf. *R.A.M.*, xxvi, p. 233] it is stated that the seven physiologic races of stem [black] rust [*Puccinia graminis*: ibid., xxvii, p. 68] present in Kenya can be maintained more easily in cages fitted with 'Windolite' than in

muslin ones. These races have been tested out on new hybrids and on differential varieties to determine the races present locally. Preliminary greenhouse trials with *P. glumarum* [loc. cit.] indicated that it could be successfully maintained at altitudes below 8,000 ft., the heavy infection of susceptible varieties being obtained by mass inoculation [see next abstract].

The potatoes 914*a* (91) and 835*a* (3), resistant to blight [*Phytophthora infestans*], having been successfully grown in Kenya since 1944, were distributed to farmers for multiplication, and yielded 11 and 19 tons per acre, respectively, when grown under favourable conditions at 8,500 ft. These varieties and others on trial have maintained blight immunity in all districts. Six new seedlings received during the year from Dr. Black of the Scottish Plant Breeding Station are immune from strains A and C [ibid., xxvii, p. 151], either or both of which are probably present in Kenya, but susceptible to B, of which there is no evidence at present [ibid., xxvii, p. 224]. Another seedling in production is immune from A and B but susceptible to C. Among the immune hybrids received from the United States which are maintaining their resistance under Kenya conditions is Empire [ibid., xxvii, p. 151]. Of the blight-resistant varieties, Solomon Clarke 2 and Dutch Robijn [ibid., xxvi, p. 466] recently released to farmers, the latter has now been discarded after suffering blight injury in 1946. One collection, No. 41, sent to England for examination has been reported to be possibly immune from virus Y.

In further studies by Dr. A. Ciccarone on *Cupressus* canker [*Monochaetia unicornis*: ibid., xxvi, p. 555; xxvii, p. 224] *C. lusitanica* and *C. arizonica* proved as susceptible, by inoculation, as *C. macrocarpa*.

A disease new to Kenya and probably introduced from America [ibid., xii, p. 254], where it also occurs on the same host, is leaf cast of *Pinus insignis* caused by *Naemacyclus niveus* [ibid., xxii, p. 186].

Several young *Eucalyptus globulus* trees in a plantation at 8,000 ft. were girdled and broken off by a stem canker disease which appeared to originate from lesions on a leaf. A few conidiophores and conidia of an undetermined *Botrytis* sp. were found on diseased material while isolations from stem cankers and leaf lesions yielded cultures bearing conidia and sclerotia of the same fungus. Sclerotia also developed on diseased material kept under moist conditions.

The non-emergence of the parasite (*Anaphoidea nitens*) of the *Eucalyptus* snout beetle (*Gonipterus scutellatus*) in one area was attributed to an entomogenous fungus, the mycelial characters of which suggested an *Empusa* sp.

A stand of *Commelina* (? *nudiflora*) extending for several yards was almost destroyed by *Kordyana celebensis* [ibid., ii, p. 341].

An unidentified leaf disease of *Anona* [*Annona*] *reticulata* in the Limuru district, characterized by large, black lesions, frequently extending to the petiole, caused considerable defoliation. The lesions exhibited dark, irradiating mycelial strands fringed with white on the upper surface of the leaf. The immersed pycnidia were irregularly scattered in the leaf tissue and broke through the upper surface. The hyaline, uniseptate, straight or slightly curved pycnospores, measuring 10 to 12 by 2 to 3 μ, resembled those of the genus *Ascochyta*. In culture the fungus produced a dark mycelium and pycnidia and was actively parasitic in leaf inoculations.

THORPE (H. C.). **Annual Report of the Senior Plant Breeder, 1946.**—*Rep. Dep. Agric. Kenya, 1946*, pp. 153–159, 1948.

The author reports that the predominant physiologic race of *Puccinia graminis* appeared to be K 6. Equator [*R.A.M.*, xxvii, p. 68] was again the staple wheat variety at high altitudes, owing to its resistance to yellow rust (*P. glumarum*). The high-yielding wheat varieties Regent R.L. 975.6 and Equator II were released for general cultivation in the Colony. The former is resistant to orange leaf [brown] rust [*P. triticina*] and to *P. glumarum* up to 8,000 or 8,500 ft. and, although

susceptible by inoculation in the seedling stage to races K 6 and K 7 of *P. graminis*, has not rusted in the field, while Equator II, a single plant selection from Equator, is also resistant to black and yellow rust [see preceding abstract].

Fifty-ninth Annual Report of the Texas Agricultural Experiment Station, 1946.—104 pp., 71 figs., 2 graphs [? 1947. Received March, 1948.]

This report [cf. *R.A.M.*, xxvi, p. 379] contains the following items of interest. A new cantaloupe variety (K–15) with strong resistance to downy mildew [*Pseudoperonospora cubensis*: ibid., xxv, pp. 333, 384] has been developed at the Weslaco station. Decay in lemons due to *Diplodia* stem-end rot [*D. natalensis*: ibid., xxiii, p. 340] was reduced by 85 to 98 per cent. using a one-minute dip in ethyl mercurithiosalicylate (1 in 10,000) or the nitrogen trichloride gas treatment (Dekko process) [cf. ibid., xxiii, p. 104]; when both treatments were used the reduction was 99·5 per cent., untreated lots showing 50 to 75 per cent. infection.

Copper sprays applied to a tomato field affected by an epidemic of nailhead rust (bacterial spot) [*Xanthomonas vesicatoria*: ibid., xxiv, pp. 252, 478] almost doubled the yield of marketable fruit over that of the untreated fields.

Wheat loose smut (*Ustilago tritici*) [ibid., xxvi, pp. 385, 445] causes annually an estimated loss of 360,000 bush. in Texas. Work is in progress to incorporate the resistance of Austin [loc. cit.] and other varieties into new varieties resistant to smut and rusts [*Puccinia graminis* and *P. triticina*] and adapted to all the wheat-growing areas of Texas.

Fifty-seventh Annual Report for the fiscal years ending June 30, 1945 and June 30, 1946.—*Bull. Ark. agric. Exp. Sta.* 464, 23 pp., 11 figs., 1946. [Received March, 1948.]

The following items in this report are of phytopathological interest [cf. *R.A.M.*, xvi, p. 156]. Tests conducted by the Plant Pathology Department for the past three years have shown that the cotton varieties Arkot 1 and 2, derived from Rowden and Stoneville 2–B, respectively, possess resistance to wilt [*Fusarium vasinfectum*: ibid., xxvi, p. 543; xxvii, p. 122].

The oat varieties Traveler, De Soto, Stanton, Letoria, Fullgrain, and Victorgrain are highly susceptible to *Helminthosporium victoriae* [ibid., xxvii, p. 181], while the Red Rustproof strains appear to be resistant. Besides seed treatment [ibid., xxvi, p. 390], control measures include increasing the rate of seeding, late planting, and crop rotation. The results of six years' tests have shown that in Arkansas Bordeaux mixture should be replaced by fermate for controlling tomato defoliation due to leaf-spotting fungi [unspecified]. Although spraying may be unprofitable in mild disease years, great benefit is derived in bad seasons, such as 1945.

Rawlins (T. E.) & Desjardins (P. R.). **The microscopic detection of bacterial infections in plants.**—*Phytopathology*, xxxviii, 2, pp. 154–155, 1 fig., 1948.

The use of oblique illumination to produce a dark field has been found to bring oozing bacteria into much greater prominence than does direct lighting, the former procedure showing the organisms as a brilliant white column against a dark background. A microscope lamp producing light of fairly high intensity will serve as a source of oblique illumination, which is produced by removing the condenser and moving the concave mirror over to one side or attaching it to a ringstand in the required position. The 16-mm. low-power objective must be used to obtain a satisfactory dark field with this system of illumination.

In the case of bacterial leaf spots a cut is made through the middle with a razor blade and the cut tissue mounted on a slide under a cover glass, at the edge of which a drop of clear water is added. The cut end of a stem may be mounted in

a drop of water without a cover glass and thick longitudinal sections under one. The cover glass should not be touched after mounting if the bacteria are to remain near the point of exudation from the cut end of the tissues.

Brown (A. M.). **Ergot of cereals and grasses.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, p. 15 [? 1947].

Inoculations with pure cultures of *Claviceps purpurea* [*R.A.M.*, xxvi, p. 390] showed that in Manitoba a single strain attacks rye, barley, wheat, oats, and various grasses. Another strain, found on *Zizania aquatica*, was unable to attack cereals and other grasses, and its sclerotia, unlike those of the other strain, were found to float on water.

On potato dextrose agar both strains produced dense, white, occasionally light purple mycelium with few conidia. The addition of barley malt to the medium increased conidial production, but sclerotia did not develop in pure culture. Cultures from single ascospores infected rye and gave viable sclerotia. Sclerotia, stratified in moist sand and stored for two months at 5° C., grew normally after one month at room temperature.

Experiments from 1942 to 1945 showed that the amount of ergot depended upon the numbers of sclerotia in adjacent, unploughed rye stubble, strips of which were intersown with strips of autumn and spring rye. In 1944 ergot was recovered from the autumn rye at a rate of 175 to 200 lb., and from the spring rye at 75 to 100 lb. per acre. Production appeared to be influenced by thickness of stand and time of flowering. The autumn rye stand was much thicker than that of the spring rye, and the autumn rye flowered in June, coincident with heavy ascospore showers which reached their peak in late June; the spring rye flowered in July during light ascospore showers.

All the strips were ploughed after harvest in 1944. On the same land two strips of autumn and two of spring rye, interspersed with fallow strips, were sown. Seed containing a large quantity of viable ergot was sown 3 in. deep. Though the season favoured sclerotial germination, few ascospores were trapped, and neither crop was noticeably infected. Digging showed that the sclerotia had germinated well, but the stalks had not reached the surface. Experiments in other years gave similar results.

Watts Padwick (G.). **Plant protection and the food crops of India. I. Plant pests and diseases of Rice, Wheat, Sorghum, and Gram.**—*Emp. J. exp. agric.*, xvi, 61, pp. 55–64, 1948.

This is a discussion, based chiefly on personal opinions of workers, of the losses caused by the principal diseases of the more important food crops in India, current control methods and the means of ensuring their adoption, and the further research that is required. Concerning diseases of rice it is recommended that research on leaf spots caused by *Cochliobolus* [*Ophiobolus*] *miyabeanus* [*R.A.M.*, xxvii, p. 294], *Curvularia lunata* [ibid., xxv, p. 182], and *Cercospora oryzae* [ibid., xxv, p. 576], should include a full study of the epidemiology and biology of the fungi concerned, as well as the selection and breeding of resistant varieties [loc. cit.]. Blast (*Piricularia oryzae*) [ibid., xxiv, pp. 128, 472] is of great importance in Mysore, where it affects 15 to 20 per cent. of the total crops. Foot rot (*Gibberella fujikuroi*) [ibid., xviii, p. 88] causes severe injury in parts of the eastern and central United Provinces.

Of the wheat diseases damage caused by the rusts *Puccinia graminis*, *P. glumarum* [ibid., xxvi, p. 440], and *P. triticina* [ibid., xxvi, p. 115] in the Central Provinces, Berar, and the Central Indian States during 1946–7 reduced the normal yield by approximately one-half, while loss for all India in 1947 is estimated at 2,000,000 tons. The breeding of resistant varieties seems to be the only economical method of control.

Loose smut (*Ustilago tritici*) [ibid., xxvi, p. 44] causes severe and steady losses throughout India, and in the submontane area of the Punjab, where flag smut (*Urocystis tritici*) [ibid., xxvi, pp. 144, 173] reduces the yield by an average of 5 per cent., combined resistance to both smuts is desirable. To guard against bunt (*Tilletia caries* and *T. foetens* [*T. foetida*: ibid., xxiv, p. 224]), responsible for losses up to 20 and 40 per cent. in Baluchistan and Kashmir, respectively, a suitable seed dressing [ibid., xxv, p. 495] should be employed before sowing in areas above 5,000 ft. Seed dressings are useless against Karnal bunt (*Neovossia indica*) [ibid., xxvi, p. 44], whereas it is believed that they would substantially reduce losses from foot rot caused by *Helminthosporium*, which amount to about 5 per cent. of the late sown crop in the Central Provinces.

Grain smut of sorghum (*Sphacelotheca sorghi*) [ibid., xxvi, p. 440] causes an annual loss in yield of about 5 per cent. in all areas where the crop is grown. Some leaf diseases which occur in conjunction with it and probably add considerably to the loss are *Titaeospora andropogonis* [ibid., xxv, p. 260], *Colletotrichum graminicola*, *Helminthosporium turcicum*, and *Curvularia lunata*. It is not known whether these are controllable by sulphur seed treatment [ibid., xxiii, pp. 293, 294], and trials should be made to determine whether any dressing is more effective than the latter.

Gram (*Cicer arietinum*) wilt (*Fusarium orthoceras* var. *ciceri*) [ibid., xxvi, p. 144] appears to be due to a complex of several root diseases, including *Operculella padwickii* [loc. cit.], and causes the death of a large proportion of plants over wide areas. Losses from gram blight (*Mycosphaerella rabiei*) have been reduced by the use of resistant varieties [ibid., xxi, p. 120; xxiii, p. 425].

Johnson (T.). **Intervarietal crossing in Puccinia graminis Pers.**—Abs. in *Proc. Canad. phytopath. Soc.*, *1947*, 15, p. 14 [? 1947].

In crosses between varieties of *Puccinia graminis*, the *tritici-secalis*, *agrostidis-poae*, and *avenae-agrostidis* crosses were of relatively high fertility, *avenae-tritici* and *avenae-secalis* were much lower, but with *tritici* and *agrostidis* the degree of fertility varied according to the direction of the crosses; *tritici* × *agrostidis* succeeded moderately well, but the reciprocal crosses did not produce aecidia.

In general, the hybrid rusts had a wider range of pathogenicity than either of the parental varieties, but the widening of host range was at the expense of pathogenic vigour. It would seem that there may be two factors tending to prevent the appearance in nature of new stem rust strains of hybrid origin, one being intersterility, the other that most hybrids are so constituted pathogenically that they do not easily find a very susceptible host.

Ekbote (R. B.) & Sahasrabuddhe (K. R.). **Shrivelled Wheat grain from rust-affected crop as seed.**—*Nature, Lond.*, clxi, 4090, p. 442, 1948.

In 1946 wheat crops in the Central Provinces and Berar, India, suffered serious losses from black stem rust (*Puccinia graminis tritici*) [*R.A.M.*, xxvi, p. 440], resulting in an acute shortage of seed.

Tests indicated that the germinability of shrivelled grain from affected crops was fairly satisfactory, especially if very thin grains were rejected. It is estimated, however, that the yields would show a loss of about 40 per cent., although under favourable weather conditions this would probably be less. Because of the serious grain situation in India, the use of shrivelled grain for seed is recommended.

Cherewick (W. J.). **Determination of smut spore load on cereal seed grain.**—Abs. in *Proc. Canad. phytopath. Soc.*, *1947*, 15, p. 14 [? 1947].

The method of determining the smut [*Tilletia* spp.] spore loads present on cereal seed samples [by washing and centrifuging: *R.A.M.*, xxiii, p. 434] was found reliable for ordinary seed testing, particularly with wheat seed. Wash water

containing 0·05 per cent. aerosol OT [ibid., xxv, p. 4 *et passim*] washed off over 90 per cent. of smut spores. Washings of five separate lots from each of several wheat samples bearing light to moderate spore load gave very close readings. With heavier spore loads the readings varied greatly.

Sallans (B. J.). **Recovery in Wheat following initial stunting caused by Helminthosporium sativum.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, p. 16 [? 1947].

In field and greenhouse studies wheat stunting caused by *Helminthosporium sativum* [*R.A.M.*, xxvii, p. 229] was indicated by the areas of the first three leaves being about 60 to 70 per cent. of the areas of corresponding healthy leaves. Recovery was indicated by the fourth, fifth, and sixth leaves (and others, when present) tending to equal or exceed in area the corresponding leaves of healthy plants. In certain experiments the excess of leaf area in the inoculated plants was sufficient to produce a statistically significant larger yield than in the uninfected. This occurred only when the growth conditions were good.

Similar tendencies to recovery were observed when leaf stunting was induced by soil inoculation with *Pythium arrhenomanes*, or by clipping off parts of the first three leaves, or by seed treatment with formalin. When small grain was used to obtain small seedlings, these tended to recover as regards the size of the later-formed leaves in the same way.

Henry (A. W.) & Gilpatrick (J. D.). **Relative pathogenicity of single and mixed strains of Ophiobolus graminis Sacc.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, pp. 14–15 [? 1947].

In greenhouse experiments on wheat take-all, virulent strains of *Ophiobolus graminis* [*R.A.M.*, xxvii, p. 228] were not appreciably reduced in pathogenicity as a result of mixing with less virulent strains. Different amounts of inoculum of a non-pathogenic strain added to that of the pathogenic strain appeared to exercise a diluting effect only. The evidence suggests that mixtures of strains of *O. graminis* might be used in testing the relative susceptibility of host species and varieties.

Watson (I. A.) & Butler (F. C.). **Resistance to Barley leaf rust (Puccinia anomala Rost.).**—*Proc. Linn. Soc. N.S.W.*, lxxii, 5–6, 333–334, pp. 379–386, 1948.

The results of research work carried out at the University of Sydney, in which d'Oliveira's test varieties of barley [*R.A.M.*, xviii, p. 387] were inoculated with collections of *Puccinia anomala* [*P. hordei*: ibid., xviii, p. 239; xxvi, p. 99] from Victoria, Queensland, and New South Wales, indicate that the physiologic race occurring in Australia is unlike any of the 30 races reported from Europe. Using one of the rust collections on F_1, F_2, and F_3 progeny of a cross II 21.15 (Smooth Awn × Manchuria) × No. 22, it was found that the two single factors for resistance, Pa_1 and Pa_2, possessed by the parents are not allelic and are inherited independently. No segregation occurred when (Smooth Awn × Manchuria) was crossed with varieties having a similar type of resistance. Plants possessing the Pa_1 type of resistance react with considerable flecking but no fully susceptible pustules are formed; Pa_2 allows the development of some rust. Plants homozygous for both factors react with flecking.

Preliminary studies indicate that there are probably not many loci involved in conveying resistance to *P. hordei*.

Russell (R. C.). **Studies on the hot water method of treating seed Barley for the control of true loose smut, Ustilago nuda.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, pp. 15–16 [? 1947].

Good control of barley loose smut (*Ustilago nuda*) [*R.A.M.*, xxii, pp. 297, 382; xxiii, p. 11] with comparatively minor loss of yield was obtained both in green-

house and field experiments when the seed was pre-soaked for five hours in water at approximately 72° F., placed directly in a water bath at 125° to 126° for eleven minutes, cooled quickly in water, drained, and then dried for five days before sowing. Very good results also followed from large-scale tests of this method, using wire baskets (designed by H. Gerrie and holding about 1½ bush. seed), which were pumped up and down in the hot water to ensure uniform heating of the seed.

Schulte (H.). **Mercury hazards in seed treating.**—*J. indust. Hyg.*, xxviii, 4, pp. 159–161, 1946.

The results of an inquiry undertaken by the Kansas City Area Industrial Hygiene Service at the instigation of an insurance company indicated that the disinfectant treatment of seeds with mercury compounds, such as ethyl mercury phosphate and ethyl mercury chloride, involves great risk to the operators of mercurial poisoning and dermatitis. The mercury contents of the fungicides in question usually range from 0·75 to 4 but may be as high as 17 per cent. The writer's preliminary investigation was carried out at a plant engaged in the cleaning, treatment, and storage of seed maize, the fungicide (consisting of 1 per cent. ethyl mercury phosphate and 99 per cent. inert matter) being added to the grain mechanically and continuously at the rate of about 1½ oz. per bush. Recommendations are made for improvements in ventilation, protective equipment, proper sanitation, and so forth.

Ruggieri (G.). **Possibili casi di tracheoverticillosi fra gli Agrumi.** [Possible cases of tracheoverticillosis in Citrus trees.]—Reprinted from *Ital. agric.*, *1946*, 8, 4 pp., 1946. [Received 1948.]

After the discovery of *Verticillium albo-atrum*, causing severe tracheoverticillosis [*R.A.M.*, xv, p. 474; xvi, p. 353] of olives in Italy [ibid., xxvii, p. 286], growing among citrus groves the author conducted experiments to determine whether *V. albo-atrum* was associated with unusual internal and external symptoms of tracheomycosis of citrus trees growing among the olives. Accordingly, young citrus plants protected from tracheomycosis infection were inoculated in May, 1946, with *V. albo-atrum* isolated from the olive trees. Two months later transverse sections through brownish, discoloured wood revealed the presence of gum and *Verticillium* mycelium, which in some cases extended as far as 15 cm. above the point of inoculation, these symptoms corresponding to those seen in the original trees. The results show that tracheoverticillosis can occur in nature in citrus plants.

Carrante (V.) & Ruggieri (G.). **Esperienze di inoculazione della Deuterophoma tracheiphila Petri.** [Inoculation experiments with *Deuterophoma tracheiphila* Petri.]—*Ann. Sper. agr.*, N.S., i, 3, pp. 463–471, 1947. [English summary.]

To ascertain whether there are two distinct physiologic forms of *Deuterophoma tracheiphila*, one causing the ordinary, slow type of citrus 'mal secco' disease, and the other the rapid type known as 'mal nero' [*R.A.M.*, xxv, p. 497], the authors in November 1945 isolated the fungus from two Femminello lemon trees at Acireale showing, respectively, 'mal nero' and 'mal secco'. The two strains, which showed no appreciable morphological differences, are referred to as N and R, respectively. Four bitter orange seedlings were inoculated with strain N on 17th December, 1945, and four with R, the inoculations being made in wounds in the trunk. The first symptoms developed during the second fortnight in March. The seedlings inoculated with strain N did not develop any more rapid infection than those inoculated with R.

The fungus was reisolated and inoculated by the same method on 22nd April, 1946, into young bitter orange grafted on Monachello lemon, three trees being used

for each strain. The results obtained were almost identical with those of the earlier experiment, except that the infections in the R series were more progressive and gave more of the characteristic salmon-red discoloration of the wood. Also, the symptoms developed more quickly than in the first test.

In November, 1946, two distinct strains of the fungus, obtained from two lemon trees, one of which, of the Monachello variety, showed 'mal nero', were inoculated into the roots of two Monachello lemons about six years old. On 7th May, 1947, the tree inoculated with strain N^1 appeared to be normal, while that inoculated with R^1 showed severe, generalized 'mal secco'. Up to 3rd July the tree inoculated with strain N^1 appeared still to be in normal vegetative condition. Sections in the inoculated roots and at the base of the trunk, however, showed that the woody cylinder of some of the innermost rings displayed a brown discoloration, which reached a height of about 60 cm. from the base of the trunk. The mycelium of the fungus was readily isolated from the discoloured zone.

From the results so far obtained the authors conclude that there is no evidence of the presence of two strains of *D. tracheiphila*, one more virulent than the other.

Evidence is further presented showing that 'mal nero' is a disease which in its early stages attacks the innermost wood rings, advancing slowly for some years without showing on the green parts. It is only in the later stages, when the mycelium begins to act on the ascending sap, that the disease assumes a more rapid progress. This, together with the discoloration of the woody cylinder, has led some observers to conclude that there is a rapid form of the disease ('male fulminante'), though in reality it is only the final stage of a pathological process which has not before been externally apparent.

Goidànich (G.) & Ruggieri (G.). **Il carattere della resistenza dei Citrus al parasitismo della Deuterophoma tracheiphila Petri.** [The nature of the resistance of Citrus varieties to the parasitism of *Deuterophoma tracheiphila* Petri.]—*Ann. Sper. agr.*, N.S., i, 3, pp. 473–484, 1 col. pl., 1947. [English summary.]

Germination tests with conidia and pycnospores of *Deuterophoma tracheiphila* [see preceding and next abstracts] in hanging drop cultures, using juices extracted from the cortex and wood of sweet and sour orange (respectively resistant and susceptible to 'mal secco'), demonstrated conclusively that these juices contained substances which strongly stimulated germination and mycelial growth; there were no appreciable differences in this respect between the two varieties.

It is concluded that the resistance of citrus varieties to attack by *D. tracheiphila* is protoplasmic in nature and develops mainly when the tree is in full vegetative activity.

Goidànich (G.) & Ruggieri (G.). **Recenti osservazioni sulla biologia della 'Deuterophoma tracheiphila' Petri e considerazioni sull' eziologia del 'mal secco' degli Agrumi.** [Recent observations on the biology of *Deuterophoma tracheiphila* Petri and considerations on the etiology of Citrus 'mal secco'.]—*R.C. Accad. Lincei*, Ser. 8, iii, 3–4, pp. 395–402, 5 figs., 1947.

The mature pycnidia of *Deuterophoma tracheiphila* [see below, p. 338] generally have an ostiole which becomes surrounded by an abundant hyphenchymatous growth of irregular cellular elements (which may be as large as the pycnidium), columnar or obconical in shape. This buffer tissue appears to contribute to the rupture of the epidermal layers. *Colletotrichum gloeosporioides* shows the same morphological adaptation. Sometimes rupture may occur at undetermined points in the outer wall of the pycnidium caused by pressure of the mucous mass within or by the action of more mature neighbouring pycnidia, but the method described above is that most generally found in nature, in material from both Italy and Sicily.

In culture on agar media the ostiole is found only with difficulty; the fructifications are sometimes massed in irregular bodies and assume aberrant, crushed or gibbose shapes, attaining dimensions eight to ten times those in nature.

The pycnidia are usually arranged in one series between the outermost layers of the cortex and the epidermis of twigs killed by the fungus; occasionally they occur in the phloem, where they complete their maturity, the conidia then being liberated after the outer layers of the cortex have collapsed. The pycnidia arise from a loose hyphenchyma in groups of 25 to 40 distinct elements which are some distance from one another. Later the groups become confluent, and are arranged in more or less complete, concentric circles. The pycnidiospores develop semi-endogenously from the fertile cells, which at first occupy the whole or a large part of the centre of the fruit body and later its peripheral portion.

The conidial state of *D. tracheiphila* has not yet been observed on the host in nature, but in culture it develops readily and abundantly. The conidia usually arise from the apex of unicellular conidiophores, mostly phialide-like in appearance, but they may emerge at various points on the side or at the extremity of the fertile hypha. A characteristic feature is the formation of bundles of brown hyphae in the aerial mycelium at the centre of the colony, the fructification then showing a typical *Phialophora* appearance.

These morphological observations have led the authors to place *Deuterophoma tracheiphila* near to *Dothiorella ulmi*, for which they have proposed the name *Deuterophoma ulmi* [loc. cit.].

No pycnidia were observed on leaf scars on twigs and they were seldom seen on lemon trees affected by 'mal secco', though they were found occasionally on sour orange. It appears doubtful whether the rare pycnidia on the aerial parts of citrus trees play any great part in causing plantation epidemics. The main source of infection appears to be diseased material lying on the ground. The spores appear to be spread mostly by the wind and also, to some extent, during pruning and manuring. The most rapid and destructive form of infection takes place through wounds in the roots; to this form of attack no species or variety of citrus is resistant.

The germination of the conidia and pycnidiospores of *D. tracheiphila* in hanging drops of juice extracted from the cortex and wood of sweet and sour orange was strongly stimulated and also the subsequent activity of the mycelium. It seems, therefore, that host resistance is due to some particular reaction of the living cytoplasm to the spread of the mycelium manifesting itself when the host is in full vegetative activity. In very resistant trees the mycelium remains inactive for a long time, the tree eventually recovering from the infection. Later infections of the same tree may, however, occur. When infection, instead of spreading downwards, as usually happens, passes up the tree, the activity of the host becomes progressively arrested by the toxic products of the fungus, which pass into the ascending sap.

Bouhelier (R.). **Affections et maladies diverses des Agrumes.** [The various disorders and diseases of Citrus fruits.]—Les Agrumes de Maroc, pp. 53–64, 8 figs., Direction de l'Agriculture, Maroc, 1947.

The disorders of citrus in Morocco [*R.A.M.*, xiv, p. 517] described in this article, with appropriate preventive measures, are wilting after transplanting, sun scorch, wind injury (often leading to anthracnose caused by *Colletotrichum gloeosporioides* [ibid., xiii, p. 26; xxvi, p. 394]), oleocellosis [loc. cit.], parasitic gummosis due to *Phytophthora parasitica* [ibid., xv, p. 796; xxv, pp. 302, 557], psorosis [virus: ibid., xxvi, p. 298], anthracnose itself, and those induced by mineral toxicity or deficiency [ibid., xxiii, p. 386; xxv, p. 559]. The principal fruit rots are caused by *P. parasitica*, *C. gloeosporioides*, *Alternaria citri* [ibid., xxv, p. 393], and blue and green moulds

Penicillium italicum [ibid., xxiii, p. 13; xxvi, pp. 379, 486] and *P. digitatum* [ibid., xxvi, p. 148], respectively.

García Rada (G.). **La psorosis del Naranjo. Informe de la visita efectuada a la hacienda 'San Carlos'—La Merced-Tarma.** [Psorosis of the Orange. Report on the visit paid to the San Carlos estate La Merced-Tarma.]—*Bol. Estac. exp. agríc. La Molina* 62, 19 pp., 11 figs., 1946. [Received February, 1948.]

The writer describes the symptoms observed on 3½- to 4-year-old oranges (mostly Valencia and a few Washington Navels grafted on sour orange stocks) in a plantation on the San Carlos estate, La Merced, Tarma, Peru, which he attributes to type A of psorosis [*R.A.M.*, xxii, p. 62], hitherto unknown in the country. In another grove of four-year-old Valencias on the same estate two factors appear to be implicated in the abnormal condition of the trees, namely, the psorosis virus and the asphyxiating effect on the roots of the sandy soil with underlying clay.

McAlpin (D. M.), Parsai (P. S.), Roberts (R.), & Hope (R. H.). **'Bud-union decline' disease in Citrus trees.**—*J. Dep. Agric. Vict.*, xlvi, 1, pp. 25–31, 6 figs., 1948.

The bud-union decline of citrus trees [*R.A.M.*, xxvi, p. 241; xxvii, p. 130] was first reported in Victoria in 1941 on Valencia Late and Washington Navel orange on sour orange rootstocks and since that date the disease has spread rapidly. Trees from nursery stage up to 40 years are affected, but those on citronelle and sweet orange stocks and unworked sour orange seedlings adjacent to declining trees are unaffected. The width of functional phloem in diseased trees is less below than above the bud union and the ratio of the width of functional phloem to the total width of bark is less than in healthy trees. The following combinations in commercial groves and nurseries were susceptible or 'suspect': sweet orange on sour orange, grapefruit, kumquat [*Fortunella* spp.], and lemon; grapefruit on sour orange and Eureka lemon; and mandarin on sour orange.

Evidence was obtained that bud-union decline is readily transmitted by budding. Sweet orange buds from a diseased tree on sour orange stock worked into seedling sour orange rootstocks reproduced the disease after three months. Buds from similar but healthy trees when worked on to similar stocks developed into healthy trees. Buds from diseased trees produced healthy, symptomless, vigorous trees when worked on citronelle stock. On the other hand, buds from a healthy Washington Navel on citronelle stock produced declined trees when worked on sour orange rootstock, but healthy on sweet orange stock. The evidence obtained in these trials also indicates that the disease may be present without symptoms in certain stock-scion combinations.

Citrus-growers are advised to exclude susceptible stock-scion combinations from new plantations and to interplant their present trees with resistant combinations at the first signs of bud-union decline. Declining sweet orange trees can be used by re-working to lemon.

Batista (A. C.) & Coêlho (M.). **Pesquisas sôbre o contrôle do estiolamento de sementeiras de Coqueiro anão.** [Investigations on the control of damping-off of dwarf Coco-nut seedlings.]—*Bol. Agric., Pernambuco*, xiv, 4, pp. 297–316, 1 fig., 1947.

A tabulated survey is given of replicated experiments in the control of damping-off, associated with an undetermined *Fusarium* sp., of dwarf coco-nut seedlings in Pernambuco, Brazil. The best of eight treatments consisted in 20 minutes' immersion of the decorticated plants in a 2 per cent. solution of wettable spergon and setting them out three days later, while satisfactory results were also given by spraying with spergon (with or without decortication) and planting on the same

day. A calculation of the economic value of the treatments proved impracticable, but the outlay on an efficient fungicide is believed to be amply justified in view of the heavy losses caused by the disease, which in humid seasons may reduce the number of healthy transplants to 20 per cent. on the local soils where the writers' experiments were performed.

ERGLE (D. R.). **The carbohydrate metabolism of germinating Phymatotrichum sclerotia with special reference to glycogen.**—*Phytopathology*, xxxviii, 2, pp. 142–151, 1 fig., 2 graphs, 1948.

The course and rate of carbohydrate metabolism of sclerotia from 30- and 60-day-old soil cultures of the cotton root rot fungus, *Phymatotrichum omnivorum* [*R.A.M.*, xxvi, p. 488], growing on sterile, inorganic nutrient medium for periods of 3, 6, 9, and 12 days, were essentially the same in spite of certain differences in the initial composition of the sclerotia. Germination of 18 gm. each of 30- and 60-day sclerotia resulted in losses of 1·09 and 1·03 gm. dry matter, respectively, and in corresponding reductions of 1·22 and 1·24 gm. carbohydrates. The initial three-day period was characterized by intense metabolic activity, as reflected in the loss during that time of some half the total amount of carbohydrates used in the 12-day experiment. Germination resulted in substantial net losses of non-reducing sugars, free and bound glycogen, and some hemicellulose (the last-named during the 9- to 12-day period). On the other hand, increases were shown by reducing sugars, mannitol (0- to 9-day period), cellulose, and suberin. The free and bound glycogen reserves of sclerotia were the chief sources of substrata for respiration and synthesis. The former process was responsible for 83 to 89 per cent. of the observed loss in total carbohydrates. Glycogen mobilization was associated with a fairly high level of amylolytic activity, which tended to vary inversely with the total glycogen concentration in the germinating sclerotia.

HARRIS (M. R.). **A Phycomycete parasitic on Aphids.**—*Phytopathology*, xxxviii, 2, pp. 118–122, 2 figs., 1948.

At the Maine Agricultural Experiment Station *Entomophthora coronata* [*R.A.M.*, xvi, p. 745] has been found parasitizing the green peach aphid (*Myzus persicae*) in greenhouses, and the results of inoculation experiments suggest that it is pathogenic to the insects. Both protein- and sugar-containing media were used for the culture of the fungus, which developed most luxuriantly on maltose agar. From observations on living aphids it appears that the spores present on their bodies may germinate on the honeydew secreted by the insects. It is thought that the timely introduction of *E. coronata* into potato fields might be of value in the control of *M. persicae* and other virus-carrying aphids.

WILHELM (S.). **The dual phenomenon in the Dermatophytes.**—*Mycologia*, xxxix, 6, pp. 717–724, 2 figs., 1947.

In this interesting study single spore analyses were made of 12 isolates of *Epidermophyton floccosum* [*R.A.M.*, xx, p. 259; xxv, p. 551] and four of *Trichophyton gypseum* [ibid., xxii, p. 96] through five culture series on potato dextrose agar slants sometimes duplicated on potato dextrose peptone and Sabouraud's glucose agar. The results demonstrated that these dermatophytes are composed of two distinct constituents associated together in culture, one the conidial (C) producing abundant conidia but relatively scanty mycelium, the other mycelial (M) producing fewer conidia and more profuse mycelium. The M type arises as a mutation [cf. ibid., xxvi, p. 406] in old C cultures, even when monoconidial, and appears to be genetically stable. The difference in cultural characteristics between the C and M types of *T. gypseum* was maintained on all the media tested, the varied

growths on the different media being very striking. It is considered inadvisable to subdivide the genus *Trichophyton* on the basis of cultural characters.

E. floccosum produced many forms culturally intermediate between C and M, suggesting that in old cultures the mycelium and spores of this species become heterokaryotic with respect to C and M nuclei and that the variation exhibited upon single spore analysis results from chance segregations of these nuclear types. Old MC cultures (heterotypes) often gave rise to secondary growth from below the parent colony, generally resembling the parent C cultures.

Isolations from nature usually yield the C constituent. The loss of this type in culture may be avoided by making transfers from the extreme edge of the colony before it is completely overgrown, or by selection of the C type from single spore cultures. The M type can be recovered repeatedly as it arises in the C.

The inability of *T. purpureum* to form pigment is apparently associated with a similar type of mutation.

Millikan (C. R.). **Antagonism between Molybdenum and certain heavy metals in plant nutrition.**—*Nature, Lond.*, clxi, 4092, p. 528, 1948.

Water culture experiments with flax conducted at the Plant Research Laboratory, Burnley, Victoria, Australia, have confirmed that excess of manganese, zinc, copper, cobalt, or nickel will induce iron-deficiency chlorosis in plants [*R.A.M.*, xxvi, p. 418; see next abstract and below, p. 336], and that this can be reduced by increasing the supply of molybdenum to the solution [see next abstract], using up to 20 parts per million of the element. Manganese-molybdenum antagonism has since been demonstrated in water culture experiments with peas, cabbages, and tomatoes.

A previously undescribed disease of flax known as 'lower-leaf scorch', which can be prevented by liming, occurs on highly acid soils in Victoria. Affected plants were found to contain a higher manganese concentration than normal. During the last two seasons, the disorder has been prevented by the application of 1 to 2 lb. ammonium molybdate per acre [cf. ibid., xxvii, p. 311]. Flax grown in water cultures without molybdenum but with a normal supply of manganese and iron showed a slight general chlorosis with marginal necrosis of the lower leaves, symptoms closely resembling those of lower-leaf scorch.

Millikan (C. R.). **Effect of molybdenum on the severity of toxicity symptoms in Flax induced by an excess of either manganese, zinc, copper, nickel, or cobalt in the nutrient solution.**—*J. Aust. Inst. agric. Sci.*, xiii, 4, pp. 180–186, 3 figs., 1947.

This is the full account of experiments on the effect of molybdenum in decreasing the severity of iron deficiency symptoms in flax [see preceding abstract]. The efficiency of the molybdenum increased as the concentration was raised from 2 to 25 p.p.m. At the higher concentrations of manganese, zinc, copper, nickel, or cobalt, the addition of molybdenum or iron did not alleviate symptoms of toxicity, such as severe dwarfing of roots and aerial parts. Molybdenum at 5, 10, or 20 p.p.m. also retarded the date of appearance and reduced the severity of lower-leaf necrosis due to excess of manganese in the nutrient solution.

Millikan (C. R.). **'Pasmo' disease of Flax.**—*J. Dep. Agric. Vict.*, xlvi, 2, pp. 90–92, 96, 3 figs., 1948.

Pasmo disease of flax (*Sphaerella linorum*) [*R.A.M.*, xxii, p. 48 and next abstract] was first observed in Victoria in 1940 on plants from seed imported from Canada. Although there has been no further record of the disease, in view of its serious effects in other countries, experiments were started in 1944–5 to determine the reactions of flax varieties to *S. linorum* [ibid., xviii, p. 739] under Victorian conditions.

Fortnightly sprays with spore suspensions of the fungus produced lesions approximately 12 days later on plants enclosed in cylinders to maintain the humidity. Plants in the open became infected only shortly before maturity. Most of the varieties and species tested in moist chambers reacted with very severe or severe lesions. The following varieties showed moderate lesions: Akmolinsk, Argentine, Biwing, Blenda, Dutch (giganta) 4 G 40/65, Hercules, I.F. 808 G 38/11, J.H.C., J.W.S., Jogeva 108, Kenya, L 2 Prince, L 11 (Sussex), Lin Ameliore, Lin de Tunisie, Liral 2, Liral Crown (Egypt), Liral Dominion, Liral Prince, Malabrigo, Minnesota 11–30–52, Newland, Newland × (19 × 112), Ottawa 770 BX Buda, Ottawa 829 c, Redson, Rio, Russian × Argentine, selection I.F. 22450/30, Stormont Cirrus, Superior 54, Tammes, Tammes Blue Yellow Anthers, Tammes Flat White, Triumph, Walsh, Very Pale Blue Crimped, Victorian Commercial, and Z.P.C.; Bison × 479, Buda, Canadian Blue, Certified White Dutch, Hercules, *Linum crepitans* (Ukraine), Liral Crown, Liral Duke, Liral Prince, Martin, New Zealand, Smoky Golden, Stormont Cirrus, and Var. 8063 bore light lesions; Bison, J.W.S. × Bison, Novelty, and Russian developed very light lesions. Linseed varieties from India and Egypt appeared to be particularly susceptible. Bison was resistant in these tests, but Bolley's Golden [loc. cit.] developed severe lesions on the stems.

Sackston (W. S.). **The effect of pasmo on the yield of Flax.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, pp. 16–17, [? 1947].

During 1945 and 1946, infections of pasmo disease (*Septoria linicola*) [*Sphaerella linorum*: *R.A.M.*, xxv, p. 61; xxvi, p. 396, and preceding abstract] were experimentally induced in field plots of Viking, Redwing, Royal, and Crystal flax at Morden and Winnipeg. All were heavily infected and yields were greatly reduced due to the small size of the seeds. Highly significant negative correlations were established between yield and amount of disease. None of the 130 varieties tested in 1946 showed any real resistance.

MacLean (N. A.). **Rhizoctonia rot of Tulips in the Pacific Northwest.**—*Phytopathology*, xxxviii, 2, pp. 156–157, 1 fig., 1948.

In January, 1947, 7,000 out of 15,000 imported William Pitt tulip bulbs from Spokane, Washington, were destroyed or rendered unmarketable by a top rot. The bulbs and leaves bore grey or grey-brown, dryish lesions, the leaves being either killed or stunted and frequently adhering together. In some cases the necks were covered with a white, cottony mycelium. Necrotic tissues on potato dextrose, bean pod, and prune agars yielded a light brown mycelium making moderately rapid growth after a slow start and showing the characteristic rectangular branching and constrictions of a *Rhizoctonia*. The hyphal strands measured 6 to 8 μ in diameter. The pathogen appears to be *R.* [*Corticium*] *solani*. Other organisms present in the diseased tissues included *Penicillium* spp. and *Pythium ultimum* but none appeared, however, to be primarily implicated in the rot.

Severin (H. H. P.). **Viruses that induce breaking in color of flower petals in Pansies and Violas.**—*Hilgardia*, xvii, 18, pp. 577–594, 6 pl. (1 col.), 1947.

In California, celery calico virus [*R.A.M.*, xxv, p. 396] and western cucumber mosaic virus [loc. cit.] cause colour-breaking in the petals of pansies and violas (*Viola cornuta*). Celery calico occurs in the coastal fog belt and the hot interior regions, while western cucumber mosaic is found only in the interior. The cotton or melon aphid (*Aphis gossypii*), lily aphid (*Myzus circumflexus*), foxglove aphid (*M. solani*), and violet aphid (*Micromyzus violae*) are natural vectors of the celery calico virus. The western cucumber mosaic virus was found to be transmitted by *A. gossypii*, the bean or dock aphid (*A. rumicis*), and green peach aphid (*Myzus persicae*).

Gardeners are advised to purchase only pansies and violas free from breaking and aphid infestation. Infection was eliminated from diseased Radio violas grown out-of-doors by roguing and weekly spraying. For spraying a solution of Black Leaf 40 (3 teaspoons to 1 gal. water) with Volck or soap as an adherent is recommended as a weekly application until the vegetation on the foothills becomes dry. All diseased pansies and violas should be rogued and burned.

MacLean (N. A.) & Sprague (R.). **Rose diseases and their control.**—*Bull. Wash. St. agric. Exp. Sta.* 185, 12 pp., 5 figs., 1947.

This popular bulletin describes the symptoms and methods of controlling diseases of roses in Washington, the most important of which are black spot [*Diplocarpon rosae*: *R.A.M.*, xxvi, p. 107], powdery mildew [*Sphaerotheca pannosa*: loc. cit.], leaf and stem rusts [*Phragmidium mucronatum*: loc. cit. and *P. speciosum*], and the virus diseases rose mosaic and yellow mosaic (rose mosaic virus) and rose streak [ibid., xx, p. 365]. A key for distinguishing between 12 of the more common diseases and directions for making a small quantity of Bordeaux mixture are appended.

Tompkins (C. M.) & Hansen (H. N.). **Cyclamen petal spot caused by Botrytis cinerea, and its control.**—*Phytopathology*, xxxviii, 2, pp. 114–117, 2 figs., 1948.

Since 1935 commercial varieties of potted cyclamen in the San Francisco Bay region of California have suffered during the rainy late autumn and winter season from petal spot (*Botrytis cinerea*), the symptoms of which have already been described by Wenzl from Austria [*R.A.M.*, xvii, p.686]. Healthy plants became infected in the greenhouse after atomization with a spore suspension of the pathogen from pure cultures, the duration of the incubation period being less than 15 hours. Besides relatively high humidity, low air temperatures (45° to 60° F.) favour the development of petal spot. The disease may be controlled by daily closing of the top greenhouse ventilators at dusk, leaving those at the side wide open, and turning on two steam pipes to provide drier atmospheric conditions during the evening.

Sprague (R.) & Johnson (A. G.). **Selenophoma on grasses, III.**—*Mycologia*, xxxix, 6, pp. 737–742, 1947.

The authors consider that the genus *Lunospora* [*R.A.M.*, xxv, p. 157] was founded on essentially the same characters as *Selenophoma* [ibid., xxiv, p. 512; xxv, p. 474], which has priority. Species of *Selenophoma* usually have non-septate spores, though septa occur occasionally in spores that have been mature for a long time. Therefore, in the authors' opinion the presence of a few uniseptate spores in overwintered material of *Phragmites communis* does not justify the exclusion of *Septoria curva* from *Selenophoma donacis*. *L. curva* is based on *Septoria curva* and is placed in *Selenophoma donacis* on the basis of spore size and shape, the differences in the pycnidia and spores being due to overwintering rather than to fundamental differences in morphology. *L. oxyspora*, based on *Septoria oxyspora*, is also considered to be a synonym of *Selenophoma donacis*. *L. culmifida*, *L. suboxyspora*, *L. penniseti*, and *L. lunata* are all referable to *Selenophoma donacis* var. *stomaticola*, and also *L. avenae* on *Avena elatior*, although the spores are slightly wider. *L. bromigena* should be referred to *S. bromigena* [ibid., xxiv, p. 316; xxvi, p. 545].

Cormack (M. W.). **Winter crown rot or snow mould of Alfalfa, Clovers, and grasses in Alberta.**—Abs. in *Proc. Canad. phytopath. Soc.*, *1947*, 15, pp. 18–19 [? 1947].

Winter crown rot or snow mould, caused by an unidentified low-temperature Basidiomycete [*R.A.M.*, xxvi, p. 8], is widespread in the central and northern

parts of Alberta and Saskatchewan, causing severe damage on lucerne, alsike [*Trifolium hydridum*], white Dutch clover, timothy [*Phleum pratense*], red top [*Agrostis alba*] and creeping red fescue [*Festuca rubra*]. Infection is less prevalent on red clover, Kentucky bluegrass [*Poa pratensis*], and meadow fescue [*F. elatior*]. Iris and other garden perennials and various wild plants are also affected.

The fungus attacks the dormant plants under the snow during the first thaw, the plants being killed or weakened in irregular patches as a result of rotting of the crown buds and tissues. Disease development appears to be associated with physiological host changes. Inoculated lucerne plants brought inside at weekly intervals became susceptible at dates ranging from late November to late December in different seasons. Infection was heaviest under a slowly melting snow cover, and was also influenced by soil temperature, soil moisture, and growth of the pathogen.

DEXTER (S. T.). **A method of estimating whether hay or grain will keep in storage.** —*Quart. Bull. Mich. agric. Exp. Sta.*, xxx, 2, pp. 150–157, 2 figs., 1947.

Organisms which cause decay of stored hay and grain [see next abstract] are harmless as long as the air in the material does not reach a relative humidity of 80 to 85 per cent. for any length of time. Loose hay, when dry enough to store, contains about 25 per cent. moisture, straw 18 per cent., wheat, oats, or barley 14 to 15 per cent., and at such moisture contents these materials, if enclosed, can all maintain a relative air humidity of about 80 to 85 per cent. Therefore it is necessary to ascertain whether the humidity of a sample is such that it could maintain a dangerous relative humidity in a closed container, thus enabling an accurate estimate of its keeping potentialities in ordinary farm storage to be made.

A saturated solution of a pure salt, such as ammonium chloride, will evaporate to dryness at a relative humidity of less than 79 to 81 per cent., while the pure salt will become damp if the relative humidity is higher than this. For testing hay a representative, uniform sample is cut to fit a quart-size, wax-impregnated, cardboard carton, allowing for the free circulation of an added spoonful of the salt when the container is thoroughly shaken. In samples that are too damp for storage the salt becomes moist in about 30 seconds, while borderline cases may take one or two minutes. The salt from samples that are dry enough for storage never becomes damp. For grain, the seeds from ten representative heads in a half-pint carton should be shaken about 50 times with half a spoonful of the salt. Pure sodium chloride and pure ammonium sulphate also are suitable salts for testing.

DEXTER (S. T.). **A method for rapidly determining the moisture content of hay or grain.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxx, 2, pp. 158–166, 2 figs., 1 diag., 1947.

To determine the moisture content of hay or grain quickly and accurately [see preceding abstract] a metal 'oven' or tube about 10 in. long and 4 or 5 in. in diameter is attached to the exhaust pipe of a car or tractor. The hay-holder consists of a slit metal cylinder obtained by removing the ends from a can. This is weighed, a representative, uniform hay sample folded and trimmed to fit it loosely, and it is reweighed. The container is then inserted in the oven so that the entire sample is enclosed. The engine is raced for about 15 seconds and left to run briskly for about 60, after which the cylinder is reversed in the oven and similarly heated until the temperature of the centre of the sample reaches about 140° C. Heating is continued and the cylinder reweighed every two minutes, reversing after a minute, until consecutive weights are identical. This should take about six minutes. The moisture content of grains may be determined in a similar way using a wire-netting container.

Louw (A. J.). **Fusicladium of Apples. IV. Can this disease be stamped out?**—*Fmg S. Afr.*, xxiii, 262, pp. 28–32, 1948.

In further studies on *Fusicladium* disease of apples [*Venturia inaequalis*: *R.A.M.*, xxvii, p. 138] in South Africa, the author discusses the possibility of eradicating the disease or at least preventing any further spread by the ploughing-in or spraying of old leaves on the ground or by the application of autumn sprays to the trees.

Experiments during 1943–4 showed that ploughing-in reduced disease incidence on the leaves from 1,917 spots per 1,000 leaves to 617 but the fruits were almost equally scabbed (99 and 95 per cent., respectively). Four summer sprays with lime-sulphur reduced leaf infection to 28 spots per 1,000 leaves and fruit infection to 7·3 per cent. For spraying followed by ploughing the figures were 7 and 2·9, respectively. Where there are objections to ploughing-in, a certain measure of control can be obtained by spraying leaves on the ground with elgetol or dinitro-*o*-cresol, but at present costs are prohibitive and spraying is often ineffective owing to the thickness of the carpet of leaves. Autumn spraying before leaf fall ensures adequate coverage and requires less spray and is more effective in killing the fungus. Lime-sulphur, copper-lime-arsenic, and zinc-lime-arsenic compounds have been proved effective in tests. Leaf scorching can be satisfactorily counteracted by increasing the lime in the mixture.

However, until further tests have been made with these compounds the following control measures, in addition to the regular summer sprays, are recommended: spraying with lime-sulphur (1 gal. to 50 gals. water) immediately after picking; sowing a fast growing cover crop, such as barley, as early as possible in autumn; and the ploughing-in of this crop with the fallen leaves before spring budding (after which further cultivation should be held over until after the winter and spring rains and after the complete decomposition of the leaves). These measures should be adopted in places where *V. inaequalis* appears for the first time, especially in isolated spots, or in seasons following severe epidemics when overwintering conditions favour infection from the old leaves.

Cooley (J. S.). **Natural infection of replanted Apple trees by white root rot fungus.**—*Phytopathology*, xxxviii, 2, pp. 110–113, 1948.

For eight years (1937 to 1944) replanting experiments were carried out in two apple orchards on land cleared of hardwoods in Virginia where white root rot (*Corticium galactinum*) [*R.A.M.*, xix, p. 354] was prevalent. During this period the dead trees were removed several times, the cause of death ascertained where possible, other trees planted, and a record kept of the condition of the replants. Infection was contracted by up to 15 per cent. of the original trees in each plot, one consisting of 252 27-year-old York Imperials, Grimes Golden, Winesap, and Stayman Winesap, and the other of 80 18-year-old Winesap and Yellow Newtowns. The affected trees continued to die during the time of the observations, and by 1944 the mortality from white root rot was estimated at 3·5 per cent. in the former and 5 per cent. in the latter plot, the corresponding figures for the replants set in 1937 being 17·8 and 27·3 per cent., respectively.

From the restricted distribution of the disease and observations on the conditions promoting infection and spread, it is inferred that the presence of woody material in the soil is essential to the inception and maintenance of the pathogen, as well as to subsequent attacks on apple trees.

Wright (T. R.). **Fire blight of Bartlett Pears in storage, Wenatchee, Washington, 1947.**—*Plant Dis. Reptr*, xxxii, 2, pp. 58–61, 1948. [Mimeographed.]

In investigations carried out in August, 1947, at Wenatchee, Washington, only 13 per cent. of healthy Bartlett pears growing near those infected with fireblight

(*Erwinia amylovora*) [*R.A.M.*, xxvi, p. 65] developed lesions when ripened in storage. From another infected orchard all healthy pears remained unaffected.

Healthy pears sprayed after picking with bacterial ooze showed no infection when stored for seven weeks at 30°, 35°, and 40° F., or when ripened immediately. Infection occurred through contact after six weeks at 30°, after five weeks at 35° and 40°, and after seven days at 65°.

It is concluded that fireblight infection is likely to be of little economic importance to pears in storage.

Bazán de Segura (Consuelo). **La podredumbre morena del Melocotonero en el Perú.** [Peach brown rot in Peru.]—*Bol. Estac. exp. agríc. La Molina* 30, 13 pp., 8 figs., 1946. [English summary. Received February, 1948.]

The fungus isolated from diseased peaches from the Department of Huánoco, Peru, was identified, on the basis of its morphology on potato dextrose agar and of the effects induced on the host, as *Sclerotinia fructicola*, not hitherto recorded for the country. The methods applied for the control of this destructive disease in the United States are indicated.

Crandall (B. S.). **Phytophthora cinnamomi root rot of Avocados under tropical conditions.**—*Phytopathology*, xxxviii, 2, pp. 123–129, 1 fig., 1948.

Avocado root rot, associated with *Phytophthora cinnamomi*, was first observed at the Tingo Maria Agricultural Experiment Station, Peru, in 1944 and reported in 1945 (*Plant Dis. Reptr*, xxix, p. 536). The disease affects both nursery and adult trees on well- and poorly drained, light and heavy soils. It assumes two forms, one of which, characterized by chlorosis and sudden wilting, apparently corresponds to 'quick decline' in California [*R.A.M.*, xxiv, p. 275; xxvii, p. 31] and results from the formation of girdling cankers in the collar region. In the other form, manifested (in one grove only) by slow decline and die-back, the smaller rootlets are attacked and killed, the main roots and collar generally being spared. *P. cinnamomi* was isolated from both types of infection and its pathogenicity demonstrated by the development of typical symptoms of chlorosis and sudden wilting, followed by the recovery of the fungus from the diseased tissues. Uninoculated trees, growing under identical environmental conditions, remained healthy.

Mezzetti (A.). **Notizie su di una nuova malattia del Kaki diffusa in Italia.** [Notes on a new disease of Persimmon prevalent in Italy.]—*Ann. Sper. agr.*, N.S., i, 3, pp. 425–430, 5 figs., 1947. [English summary.]

During the past year, many reports have been received in Rome of an apparently new disease affecting persimmons, especially near San Remo and Ventimiglia, near Rome, and in the provinces of Savona and Padua. Growers state that it was first noted four or five years ago, since when it has become progressively more common. *Diospyros kaki* var. *lycopersicum* and 'kaki mela' appear to be very susceptible, whereas *D. kaki* var. *costata* and certain poor varieties appear to be resistant.

The most characteristic symptom is a blackening of the leaf veins, usually accompanied by chlorosis; the shape, area, and position of the affected leaf areas vary considerably, while some plants also show leaves with intervenal chlorosis but no blackening of the veins. These symptoms appear shortly after the new vegetation has developed and lead, early in summer, to defoliation and wilting. If the plants are vigorous, they put out new shoots, at the base of which at the beginning of summer appear suberous formations, sometimes in the form of pustules, which may turn black, and sometimes in the form of plaques with shaded edges, which simulate normal periderm production. The wood, in plants that have

been affected for some time, often shows longitudinal black bands. The trunk and roots of affected plants which do not show any severe wilting appear normal.

Histological examination showed a general browning of all the elements of the leaf veins, accompanied by various proliferations and abnormalities. No organism could be found in the affected material. Further investigations are in progress.

Richardson (E. G.). **The spraying of liquids from aircraft.**—*Sci. Progr.*, xxxvi, 142, pp. 206–213, 1 pl., 3 graphs, 1948.

For the spraying of the atmosphere and crops with disinfectant suspensions from aircraft it is necessary for the liquid to disintegrate into drops of a determinate size. The physicist's role in this problem is to calculate the optimum drop size at the ground for the purpose in view, and to investigate the conditions of break-up of the jet at the aircraft, disposing the drops in such a way that the correct drop size results at the ground. In this connexion two questions of hydrodynamics arise, namely, (1) what should be the mean drop size on formation at a definite height above the ground? (2) how may the initial drop size be assured? Little work seems to have been published hitherto on the optimum drop size for sprays on to foliage. Once this point has been determined by biologists, the requisite aircraft flight conditions can be deduced from the physical research work herein described.

Jeffers (W. F.). **Fungicide information.**—*Mimeo Md ext. Serv., Plant Path.*, 27, 44 pp., 1947.

This useful summary of information concerning commercial fungicides used in Maryland, arranged alphabetically under the trade names, includes information on the active ingredients in and nature of each product, specific recommendations and directions for their use and any precautions to be observed in applying each, and the name of the manufacturing company, the addresses of which are listed at the end of the publication. It is emphasized that most of the control recommendations were obtained from the manufacturers without test under local conditions and that the Maryland Spray Calendars should be followed in the case of fruit sprays.

Tilemans (E.). **Les composés organo-cupriques.** [Organic copper compounds.]—*Parasitica*, iv, 1, pp. 21–26, 1948.

This survey, based on the researches of previous workers, traces the development of copper compounds as fungicides from the early soluble and insoluble salts to the organic compounds and oil emulsions combined with Bordeaux mixture, and lately to copper 8-quinoleate and a derivative of phenothiazine, both recently produced in Belgium and still in the experimental stage.

Miller (P. W.) & McWhorter (F. P.). **The use of vapor-heat as a practical means of disinfecting seeds.**—*Phytopathology*, xxxviii, 2, pp. 89–101, 1 fig., 1948.

This is an expanded account of the vapour-heat method of seed disinfection, a preliminary note on which from the Oregon Agricultural Experiment Station has already appeared [*R.A.M.*, xxiv, p. 157]. The equipment is essentially identical with that devised by Latta (*J. econ. Ent.*, xxv, pp. 1020–1026, 1932; *Tech. Bull. U.S. Dep. Agric.* 672, 1939). Steam at 10 to 20 lb. pressure is released through a series of small apertures in a U-shaped pipe and mixed or 'vaporized' with air in a sheet-metal conditioning box, 5 by 3 by 3 ft., from which the vapour passes through a metal conduit into a double-walled, wooden treating room, 5 by 5 by 4 ft. The hot vapour enters the room through a square opening in the centre of the ceiling and is distributed by a perforated baffle plate suspended about 6 in. below the aperture, thereby allowing a portion of the mixture to flow downwards into the middle of the room. The vapour is subsequently withdrawn from the lower part of the room, circulated again through the conditioning box, and reintroduced

through the ceiling by means of a fan placed in the circulation 'stream'. The temperature of the mixture (ranging from 110° to 165° F. in these tests) is held constant to within ±2° by a thermostatic control appliance which operates a steam valve introducing more steam as required. The seeds were treated in trays measuring 11 by 11 by 3 cm. with 32-mesh wire screen bottoms and holding approximately 35 gm. table beet and 75 gm. cabbage seed for various periods, then transferred aseptically to sterile paper sacks, and finally plated out on potato dextrose agar to determine the viability of the internal or external micro-organisms.

Tabulated data indicate that while certain fungi are killed at relatively low vapour-heat temperatures for short exposures [*R.A.M.*, xxiv, p. 157], most bacteria are not killed by treatments that are safe for seeds and the control of bacterial seed-borne diseases by vapour heat alone appears impracticable.

Edwards (G. A.), Buell (Caroline B.), & Weston (W. H.). **The influence of mineral oil upon the oxygen consumption of Sordaria fimicola.**—*Amer. J. Bot.*, xxxiv, 10, pp. 551–555, 1 fig., 3 graphs, 1947.

A micro-respirometric technique for the rapid determination of respiratory changes of fungal cultures under oil [*R.A.M.*, xxvii, p. 81 and next abstract] is described. The oxygen consumption of *Sordaria fimicola* covered with mineral oil was found to vary according to the oil depth. A layer 1 cm. in depth [cf. ibid., xxvi, p. 481] appears to be the most suitable for conserving cultures, which, it is concluded, may be preserved under oil for several years.

Buell (Caroline B.) & Weston (W. H.). **Application of the mineral oil conservation method to maintaining collections of fungous cultures.**—*Amer. J. Bot.*, xxxiv, 10, pp. 555–561, 2 figs., 1947.

At the Harvard Biological Laboratories between September, 1944, and June, 1946, 2,700 fungus cultures were successfully preserved by lyophilization [*R.A.M.*, xxvi, p. 408] and 1,800 by the mineral oil method [ibid., xxii, p. 403 and preceding abstract]. For the latter potato maltose agar (300 gm. potato, 10 gm. maltose, 20 gm. agar per l.) yielded vigorous colonies of practically all the fungi after seven days at room temperature. Exceptionally pure, heavy Parke-Davis mineral oil of high Saybolt viscosity of not less than 330 at 100° F. and specific gravity of 0·8 to 0·9 was then added from an autoclaved apparatus consisting of a separatory funnel to the delivery tube of which an inverted small glass funnel was attached to protect the exit hole and the momentarily unplugged culture from contamination. Under these conditions 25 representative fungi selected for observation maintained slow but continuous mycelial growth. In some sporulation was retarded and sparse, as in *Nigrospora sphaerica*, abundant in others, as in *Acremoniella* sp. Subcultures grew vigorously and were identical in development and morphology with the originals. *Blakesleea trispora* remained viable after 10 and *Saprolegnia* and *Achlya* after 11 months. Many Fungi Imperfecti retained their viability after two years under oil.

The practical advantages of the mineral oil method are (1) the great simplicity of procedure, (2) the easy transfer of cultures, (3) its application to a wide range of fungi, especially to those which do not produce abundant, hardy spores, and (4) its suitability for controlling mites.

Gautheret (R. J.). **Plant tissue culture.**—*Endeavour*, vii, 26, pp. 75–79, 9 figs., 1948.

This article describes the methods of plant tissue culture and their uses in studying the problems of morphogenesis and physiology. Their application in phytopathology is also briefly discussed. In 1934 White [*R.A.M.*, xiv, p. 127] used isolated tomato roots to cultivate virus proteins and Segrétain obtained similar

results using tissue cultures. The method has also been used to culture downy mildew and *Oidium* of vine [*Plasmopara viticola* and *Uncinula necator*: ibid., xxv, p. 94] and in plant gall research [ibid., xxvii, p. 276].

THUNG (T. H.). **De versprijdingswijze van plantenziekten.** [The mode of transmission of plant diseases.]—*Landbouwk. Tijdschr.*, lix, 711–712, pp. 346–350, 1947.

Virus diseases are spread mainly by insects and those of fungal origin by spores and mycelial particles. Both insects and spores are carried by wind, currents of water, and human intermediaries, as well as through the transport of infected plants or parts thereof for commercial purposes. These various modes of transmission are discussed and illustrated by some well-known examples from the relevant literature.

MINICH (A.). **Protection of textiles from microbial attacks.**—*Rayon Text. Mon.*, xxviii, 11, pp. 92–93, 12, pp. 108–109, 3 figs., 1947.

Following a brief discussion of the available information on the microbiology of textiles, the author defines the ten qualifications of an 'ideal microbicide' and presents the results of some experiments with nuodex 100 (Nuodex Products Co., Inc.) in the control of *Aspergillus niger* and *Chaetomium globosum*, representing the surface or mildew and rotting mould groups, respectively [*R.A.M.*, xxvii, p. 147 *et passim*]. From the data obtained in pure culture, soil burial, durability (including soil contact and tropical room exposure), physical effects, and humidity chamber performance tests on cotton duck and other fabrics the following concentrations are recommended: for in-process protection against mildew, 0·1 per cent. per weight of textile; for materials likely to be exposed to extremes of weathering, e.g., sail cloth, 3 per cent.; for mattress ticking and the like, 0·3 to 0·5 per cent.; and for treatments required to pass official standards, 0·3 to 0·5 per cent. for *C. globosum*, 1 per cent. for *A. niger*, and 0·5 per cent. for a fortnight's soil burial.

Nuodex is supplied in two forms, viz., 100 S.S (solvent soluble), which may be readily diluted with many organic solvents, such as mineral spirits, petrol, naphtha, and toluol, and the water-dispersable W.D.

GROSSBARD (ERNA). **Production of an antibiotic substance on Wheat straw and other organic materials and in the soil.**—*Nature, Lond.*, clxi, 4094, pp. 614–615, 1 fig., 1948.

In trials carried out at the Experimental and Research Station, Cheshunt, to determine whether antibiotic substances could be produced in quantity in soil for the purpose of controlling soil-borne diseases, it was found that *Penicillium patulum* produced patulin (clavacin) [*R.A.M.*, xxvii, p. 113] when grown on sterilized fresh wheat straw, bracken, or sugar beet waste. The addition of 3·5 per cent. glucose to the two first-named greatly increased their inhibitory action against *Bacterium phytophthorum* [*Erwinia phytophthora*]. Autoclaved composted wheat straw and also peat inoculated with *P. patulum* produced the antibiotic substance only in the presence of glucose. This also occurred to some extent with fescue [*Festuca* sp.], lucerne, mustard, and sainfoin [*Onobrychis sativa*]. Liquid expressed from autoclaved fresh wheat straw (5 per cent.) plus water (50 by weight) and oven-dried soil inoculated with *P. patulum* completely inhibited the growth of *E. phytophthora*.

It appears that glucose or other sources of carbohydrates and their decomposition products are necessary for the production of an antibiotic substance by *P. patulum*.

Cappelletti (C.). **Ricerche fisiologiche sulla simbiosi nelle Orchidee. II contento in acqua ed in azoto in varie fasi della vita simbiotica ed asimbiotica.** [Physiological researches on symbiosis in the Orchidaceae. The water and nitrogen contents in different stages of symbiotic and asymbiotic life.]—*Lav. Ist. bot. Torino*, viii, pp. 57–76, 1947. [English summary.]

An estimation of the amount of water and nitrogen present in variously aged cultures of *Cymbidium* grown in the absence of symbiotic fungi and in the presence of *Corticium catonii* [*R.A.M.*, xix, p. 111] both in light and darkness showed that symbiotic cultures exposed to the light had a water and nitrogen content about double that of asymbiotic cultures of the same age.

The mycelium of *C. catonii* does not fix atmospheric nitrogen. While it can develop on agar in the absence of vitamins, in the protocorms of *Cymbidium* it stimulates their metabolism and supplies them with auxin-like products and aneurin. It provides nitrogen, which is largely derived from the decomposition of the mycelium.

Hawker (Lilian E.). **Stimulation of the formation of perithecia of Melanospora destruens Shear by small quantities of certain phosphoric esters of glucose and fructose.**—*Ann. Bot., Lond.*, N.S., xii, 45, pp. 77–79, 1 fig., 1948.

The addition of 0·05 per cent. of various hexose phosphates to a synthetic medium containing an adequate supply of growth substances [*R.A.M.*, xxvii, p. 289], and with either sucrose or a mixture of glucose and fructose as the source of carbon, stimulates the production of perithecia by *Melanospora destruens* [ibid., xvi, p. 199].

Potatoes.—*Bull. Me agric. Exp. Sta.* 449, pp. 261–377, 9 figs., 2 graphs, 1947.

The following are among the items of phytopathological interest in this report [cf. *R.A.M.*, xxvii, p. 86]. An experiment carried out in Maine in 1946 by R. Bonde and E. Snyder to determine the effect of different amounts of lime in Bordeaux mixture upon the yield of Katahdin potatoes and early blight [*Alternaria solani*] control [ibid., xxvii, p. 194] showed that yields were increased, though not significantly, as the amount of lime was decreased from a 10–20–100 to a 10–5–100 formula. Plots sprayed with tribasic copper sulphate yielded more and the foliage showed less spray injury than those sprayed with the Bordeaux mixtures, but the unsprayed gave the highest yields. The addition of DDT significantly increased the yield for all the spray materials. The percentages of early blight [ibid., xxvi, pp. 211, 441; xxvii, p. 89] foliage injury were 39·5 for Bordeaux mixture 10–20–100, 7·3 for 10–10–100, 3 for 10–5–100, 10 for tribasic copper sulphate, and 21·5 for the unsprayed, while for the same materials plus DDT (2 lb. 50 per cent. per 100 gals.) the corresponding figures were 5·1, 0·4, 0·6, and 0·4 per cent. The foliage injury due to Bordeaux mixture was virtually eliminated when DDT was added to the spray. The plants sprayed with high-lime Bordeaux in the absence of DDT were the shortest (16·7 in.), height increasing as the lime was reduced, those sprayed with low-lime Bordeaux being the same size as those treated with tribasic copper sulphate. The tallest plants (average 19·7) were the unsprayed.

In another experiment, neutral copper (basic copper sulphate) with either DDT or benzene hexachloride (2 lb. to 100 gals.) and Bordeaux mixture plus DDT gave good control of early blight (2·5 to 4·4 per cent. injury compared with 60 per cent. on the unsprayed). The highest yields were obtained when benzene hexachloride was used with two organic fungicides, No. 629 (containing per cent. 33·8 zinc, 25·3 sulphur, and 5 nitrogen) and No. 308 (containing per cent. 32·3 copper, 32 sulphur, and 7 nitrogen) together or with the latter only. Dithane (2 qts.) with zinc sulphate (1 lb.) and lime (½ lb.), and phygon (1–100) reduced early blight leaf

injury from 15·1 per cent. to 0·9 and 7·3, respectively, and to 0·4 and 3·4, respectively, when DDT was added. Early blight injury was also considerably reduced by using various copper dusts.

R. Bonde and D. Merriam state that the control of ring rot [*Corynebacterium sepedonicum*: ibid., xxvii, pp. 86, 118] remains an important problem in Maine. In further field tests on control only 1 per cent. of the seed pieces treated for ten minutes with mercuric chloride at 8 oz. in 30 gals. became infected, as against 43 to 74 per cent. for the same period in yellow copper oxide, basic copper sulphate, and tribasic copper sulphate. Even at higher concentrations and with treatments lasting 60 minutes the neutral coppers allowed 12 to 23 per cent. infection. Further breeding work confirmed the view that seedling 46952 has less resistance than 47102 (Teton) [ibid., xxvii, p. 37]. When Teton was selfed, 81·6 per cent. of the seedling progeny were resistant as compared with 54·6 per cent. when this parent was crossed with 46952. Erie (47101), derived from the same cross as Teton, also appears to be resistant.

An experiment was started in 1944 to investigate the rate of spread of ring rot within seed stocks showing different amounts of the disease. Affected seed pieces were mixed with healthy ones to give 0, 1, 2, 3, 4, 5, and 10 per cent. infected stocks. One thousand seed pieces of each were planted in 1944 and from each lot of progeny 1,000 seed pieces were selected at random and replanted in 1945 and 1946. The healthy seed stock contracted a trace of ring rot in the first year, but this had not materially increased by 1946. The rate of spread was low when the amount of disease in the seed stock was under 3 per cent., 1 per cent. infection increasing to 12·1 per cent. after two years, 3 per cent. to 17·1, 5 per cent. to 45·5, and 10 per cent. to 73.

In breeding work for leaf roll resistance [ibid., xxvii, pp. 34, 87] G. W. Simpson, R. Bonde, and F. J. Stevenson found that three seedlings from the hybrid B 522 (792–94 × 1241–91) showed high resistance in 1945 and 1946 and one, B 522–33, is to be used for future crosses. Nearly 11 per cent. of the seedlings from Triumf selfed remained free from leaf roll in 1945 and 1946, and four of these, B 1113–254, –369, –393, and –398, are to be used as parents.

Dykstra (T. P.). **Potato diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1881, 53 pp., 35 figs., 1948.

This is a slightly revised edition of *Bulletin* 1881 [*R.A.M.*, xxi, p. 262], supplemented by some up-to-date control measures.

Bawden (F. C.) & Kassanis (B.). **The behaviour of some naturally occurring strains of Potato virus Y.**—*Ann. appl. Biol.*, xxxiv, 4, pp. 503–516, 1 pl., 1947.

Many strains of potato virus Y [*R.A.M.*, xxvi, pp. 25, 259, and next abstract] obtained from field crops of King Edward and Majestic potatoes from different parts of England differed markedly in virulence. The symptoms caused by these strains in seven potato varieties and in tobacco are described and are compared with those caused by the serologically related virus C [? a strain of virus Y].

All the Y isolates and C from Edgecote Purple potato produced symptoms of the same general type in tobacco, viz., vein-clearing succeeded by vein-banding. Seven to ten days after infection there was slight crinkling of the young leaves and the veins became picked out by the tissue around them, becoming a lighter green or yellow. This mottle faded and was followed by pallor of the intervenal areas, dark green bands developing along the veins. Some isolates gave bright vein-clearing and vein-banding with much waving and crinkling of the leaves and stunting of the plants, while others caused milder leaf and growth symptoms.

In Majestic some Y isolates induced necrotic local lesions and severe leaf-drop streak, all the middle and lower leaves becoming necrotic and soon falling, while

the few remaining upper leaves revealed a bright mottle and marked deformity. Other isolates produced fewer and milder necroses, only the lower leaves falling, the middle and upper ones being mottled and crinkled. Some caused no necrosis but only mosaic symptoms of varying severity. In Arran Pilot none of the isolates caused necrotic symptoms, but the mosaic and rugosity produced ranged from severe to negligible. The relative virulence of the isolates appeared, however, to be much the same in the four potato varieties tested, viz., Majestic, Arran Pilot, Doon Star, and Gladstone.

Of the Y isolates obtained, seven were retained for further investigation, these being the two most virulent (Y_1, Y_2), three intermediate ones (Y_3 to Y_5), and the two least virulent (Y_6, Y_7). Y_1 was the stock culture derived from Smith's original isolate [ibid., x, p. 615].

The differences between the symptoms caused by these different isolates were wide enough for the viruses to be regarded as distinct strains. The most salient differences in the symptoms resulting from the various strain-host combinations were found in the production of necrosis in the first year of infection. Arran Pilot developed no necrotic symptoms with any strain, while Gladstone and Katahdin showed some necrosis with all, and King Edward, Majestic, Doon Star, and Arran Banner did with some strains but not others. The results clearly showed the difficulties of attempting to diagnose causative viruses from symptoms in the field. Not only does the same strain cause different symptoms in different varieties, but with each variety there is an equally wide range in the type and severity of symptoms produced by the different strains.

Diagnosis from secondary symptoms is even more unreliable, since leaf-drop streak, the one really characteristic symptom of Y, generally occurs only during the first year. Gladstone and Katahdin are exceptions, showing considerable necrosis and leaf-drop in the second year, and their reaction to most of the strains (except Y_7) was so marked that second-year plants usually succumbed when a few inches tall. Sometimes such plants reproduced first-year symptoms exactly. At first the young shoots grew vigorously and appeared to be normal, but when a few inches high they showed leaf-drop streak. The presence of Y in the shoots before the symptoms appeared could not be detected. In other varieties appreciable necrosis is seldom observed in the second year even when they are infected with strains causing leaf-drop streak as a primary symptom. Secondary symptoms consist of mosaic, leaf deformities, dwarfing, and early maturation. Occasionally, Majestic and Up-to-Date produce healthy shoots that grow vigorously for a time and then suddenly develop typical first-year symptoms of leaf-drop streak. This indicates that in these varieties the tissues react necrotically only if well developed at the time of infection, and that mosaic symptoms characterize tissues infected soon after initiation. There is no appreciable difference between the virus content of leaves from plants in the first and second year of infection.

The severity of second-year symptoms generally reflects that of the primary symptoms. With Majestic, for instance, the progeny of plants which had acute leaf-drop streak are small, deformed, brittle, and early maturing, while the progeny of plants infected with Y_6 and Y_7 are only slightly dwarfed and mature only a little earlier than healthy plants. Though Arran Pilot shows only slight effects in the first year, second-year plants are dwarfed, mature early, and have greatly reduced cropping power; there is, however, much variation from strain to strain, and Y_1 has a much greater crippling effect than Y_7. A fairly general second-year symptom in plants infected with strains that allow the plants to attain a moderate size is that the stems early become prostrate.

Virus C causes a wider range of symptoms than any of the Y strains and was more virulent than Y_1 in Majestic, King Edward, and Doon Star. It was the only one which caused top necrosis.

Virus Y was experimentally transmitted from tobacco to tobacco by *Myzus persicae*, *M. ornatus*, *Macrosiphum solanifolii*, *Aphis rhamni*, *A. fabae*, *Aulacorthum* [*M.*] *circumflexum*, *A.* [*M.*] *solani*, *Canariella pastinacae*, and *Macrosiphoniella sanhorni* and to potato by *Myzus persicae* only. Virus C was not transmitted by any of the aphids tested.

It is concluded that potato virus Y is far from being the single, uniform entity it is widely assumed to be. The range of diseases caused by the many strains of Y is as great as that caused by X, and as the two diseases overlap considerably it is not always possible to tell from the appearance of a potato plant whether it is infected with a strain of X or Y. During the work, the various strains of Y remained constant, and no evidence was obtained that changes analogous to mutations are of great frequency, though clearly they do occur. Apparently, the most frequent mutant is one identifiable by a change of virulence towards certain hosts.

It is considered that breeding for resistance might be worth while. Katahdin was much more difficult to infect than any other variety studied, though it reacts severely when infected. The combination of resistance and intolerance appears to be worth seeking.

Schultz (E. S.), Stevenson (F. J.), & Akeley (R. V.). **Resistance of Potato to virus Y, the cause of vein-banding mosaic.**—*Amer. Potato J.*, xxiv, 12, pp. 413–419, 1947.

Tests carried out on Aroostook Farm, Presque Isle, Maine, from 1937 to 1944 on the reaction of different potato varieties to virus Y [*R.A.M.*, xix, p. 671 and preceding abstract] showed that the virus caused more severe injury in combination with other viruses [unspecified] than when it occurred alone. Most commercial varieties harbour latent mosaic virus [potato virus X], and when infected with Y develop the severe reaction known as rugose mosaic [ibid., xxi, p. 499].

The varieties and seedlings tested could be grouped as: (1) highly resistant, i.e., seldom contracting more than a trace of infection in the field; (2) moderately resistant, showing 10 to 20 per cent. infection by plant count; (3) slightly resistant, with up to 100 per cent. infection; and (4) non-resistant, contracting virtually 100 per cent. infection.

The extent to which varieties exhibited resistance depended on the aphid (*Myzus persicae*) dosage; varieties apparently resistant in the field were not necessarily resistant under heavy aphid infestation in cloth cages. Resistance was heritable; a greater number of resistant seedlings were found among the progeny from highly resistant than from non-resistant parents and they may be more resistant than the parents. Unless aphid vectors were abundant, not all susceptible varieties necessarily became infected in a single season's exposure test.

Stevenson (F. J.). **Potato breeding, genetics, and cytology: review of literature of interest to Potato breeders.**—*Amer. Potato J.*, xxv, 1, pp. 1–12, 1948.

This review, based on the literature to which there are 39 references, covers all aspects of potato cultivation which are of interest to growers, including breeding, classification and cytology, cytogenetics, resistance to viruses and fungous diseases, and new varieties.

Afanasiev (M. M.) & Morris (H. E.). **Time of infection and accumulative effect of Rhizoctonia on successive crops of Potatoes.**—*Amer. Potato J.*, xxv, 1, pp. 17–23, 4 graphs, 1948.

To study the time and degree of infection of the various parts of the potato plant by *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xxvii, p. 254], Bliss Triumph potatoes, certified practically free from the disease, were treated with formaldehyde, cut and planted at Huntley, Montana, in 1936 in soil not previously planted with potatoes

for 25 years, and in successive years in the same plot until 1940. The stems, stolons, and roots all showed a low percentage of infection, as indicated by the presence of lesions, during the first two years but during the last three (1938 to 1940) the maximum readings for the stems were 82, 75, and 75 per cent., respectively. The infection percentage for the stolons gradually increased from the third year, the 1940 reading being 95 per cent. Root infection increased gradually from 1938, although infection was slight throughout the experiment, the highest being 67 per cent. in 1940. The tubers were only slightly infected with sclerotia in 1936, but after the second year infection increased rapidly until the maximum of 66 per cent. was reached in 1939.

The results show that potato stems, stolons, and tubers are very susceptible and potato roots somewhat resistant to infection by *C. solani*. It appears that under favourable conditions only one to two years are required to build up sufficient inoculum in the soil to produce maximum infection. Long rotations combined with tuber treatment should control the disease to a great extent.

Richardson (L. T.) & Phillips (W. R.). **Low temperature breakdown of Potatoes in storage.**—Abs. in *Proc. Canad. phytopath. Soc., 1947*, 15, p. 18 [? 1947].

Physiological low temperature breakdown accompanied by blackening on cooking [*R.A.M.*, xxvii, p. 153] occurs when certain potato varieties are stored at temperatures just above the freezing-point of the tissues. Light-reddish to dark-brown areas develop in the flesh, and diffuse, metallic, brownish-black patches often appear on the skin. Of the varieties tested, Katahdin was most susceptible, followed in order of decreasing susceptibility by Chippewa, Irish Cobbler, Dooley, Green Mountain, and Warba, the two last-named being highly resistant. Injury was reduced when the tubers were packed in moist sphagnum moss. Exposure to 32° F. for two months at the beginning of storage was more harmful to Katahdin tubers than similar exposure at the end of the storage period. Low temperature breakdown retarded or inhibited bud development in tubers of susceptible varieties, such tubers producing weak plants with small yields. A storage temperature of 36° is considered to be the best, especially for seed potatoes.

Lachavanne (G.) & Rautou (S.). **Le Riz en Italie.** [Rice in Italy.]—*Progr. agric. vitic.*, cxxix, 10–11, pp. 164–172, 8 figs., 1948.

Following a visit to the rice-growing station at Vercelli, Italy, the authors give notes on the selection work carried out there. The two principal diseases of rice in Italy are brusone [*Piricularia oryzae*: *R.A.M.*, xxvi, pp. 143, 466] and helminthosporiosis due to *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: ibid., xxvi, p. 143, and above, p. 314], *H. maculans* [syn. *Cladosporium oryzae*: ibid., xii, p. 146], and other fungi [unspecified]. The best old varieties, Bertone, Astiglia, and Nostrale, are no longer grown, because of their susceptibility to brusone. This disease caused a grave crisis in the Italian rice-growing industry, which has been solved by the introduction of a resistant variety, Chinese Originario, from which Americano 1600 and Colusa de Californie were subsequently obtained. Other resistant varieties which have been developed are A. Chiapelli and Senatore Novelli.

Under Italian conditions helminthosporiosis appears in June or July, an average daily temperature of at least 18° C. being necessary for the germination of the spores. The loss caused by the disease is to some extent limited by climatic factors. Senatore Novelli and A. Chiapelli show marked resistance.

Tullis (E. C.) & Adair (C. R.). **Black sheath rot of Rice (Ophiobolus oryzinus) caused lodging of Rice in Arkansas and Texas in 1947.**—*Plant. Dis. Reptr*, xxxi, 12, p. 468, 1947. [Mimeographed.]

For the first time since it was originally reported in 1923 [*R.A.M.*, xi, p. 469],

black sheath rot (*Ophiobolus oryzinus* Sacc.) occasioned appreciable damage during 1946 and 1947 to rice in Arkansas and Texas by causing lodging, breaking of culms at the nodes, and incomplete filling of the grain. In Arkansas, in 1946, the culms of Nira rice were prematurely killed, and in 1947 the Prelude variety in an adjacent field was affected, the outer sheath tissues yielding numerous fertile perithecia. In variety tests in Arkansas, Nira, Bluebonnet, Cody, Asahi, Fortuna, Kamrose, Texas Patna, and Hill Patna showed some resistance to the disease.

Beeley (F.). **Annual Report. Pathological Division.**—*Rep. Rubb. Res. Inst. Malaya, 1940*, pp. 89–103, 1947.

In this report [cf. *R.A.M.*, xxi, p. 390] it is stated that the white fluid fungicides paragerm and 'ialine ordinary disinfectant' effectively controlled mouldy rot of rubber trees (*Ceratostomella fimbriata*) [ibid., xxi, p. 323; xxvi, p. 417] during maximum infection brought on by heavy rain. Bark from trees infected with brown bast [ibid., xxv, p. 183] and still in tapping contained more bacteria than are usually observed in healthy tapped bark, whereas few or none were found in bark from an infected tree rested for some months, probably due to the effect of gummation and meristem activity.

During periods of heavy rainfall frequent inspection and treatment are necessary for the control of pink disease (*Corticium salmonicolor*) [ibid., xviii, pp. 341, 342]. Flaming infected branches with a low temperature smudge flame prior to pruning or to the application of fungicides is suggested as a control method, although its possibilities have not yet been fully investigated. Spearhead die back of young buddings was attributed to the hot, dry weather causing desiccation of the stock tissue and preventing sufficient supplies of moisture reaching the bark above. Callus growth is promoted by painting the stock and scion with white paint or lime-wash. Further occurrence of bark-bursts and the formation of coagulum between the bark and wood, apparently of physiological origin, have been observed. The latex pad [ibid., xx, p. 35] prevents healing by callus tissue, so that the wound can sometimes be traced in the wood to a depth of 1 or 2 in.

Hewitt (E. J.). **Relation of manganese and some other metals to the iron status of plants.**—*Nature, Lond.*, clxi, 4091, pp. 489–490, 1948.

The results of experiments at Long Ashton Research Station, Bristol, with sugar beet seedlings in nutrient sand cultures, to which lead, zinc, copper, cobalt, nickel, manganese, and chromium ions were added at concentrations of 0·5 and 1 milli-equivalents per l. in addition to iron compounds, indicate that cobalt, copper, zinc, nickel, and chromium (in decreasing order of severity) are more active in inducing iron deficiency symptoms than is manganese [*R.A.M.*, xxvi, p. 418]. Chlorosis typical of iron deficiency, developing in the young leaves of all plants, was attributed to failure in the iron metabolism. Necrosis, which was very severe with cobalt and nickel, and dwarfing also developed and were considered to result from toxicity. Field observations have shown that iron deficiency symptoms may be caused by cobalt or nickel in acid soils [loc. cit.].

In another experiment symptoms of manganese toxicity distinct from and unaccompanied by those of iron deficiency were produced in the older sugar beet leaves, confirming previous conclusions that manganese toxicity and manganese-induced iron deficiency are independent effects.

Manganese deficiency in older leaves occurred simultaneously with iron deficiency symptoms in the younger leaves of a plant given extra zinc, and also in oat plants grown without either element in sand.

Trace elements in plant physiology.—*Nature, Lond.*, clxi, 4088, pp. 364–365, 1948.

On 5th and 6th November, 1947, a symposium on trace elements in plant physio-

logy was held at Rothamsted Experimental Station, Harpenden, under the auspices of the International Union of Biological Sciences.

Prof. Steenbjerg described trace element investigations in Denmark and reported iron and manganese deficiencies in horticultural crops and copper deficiency in sandy soils in Jutland [*R.A.M.*, xxv, p. 106].

Bean (*Phaseolus vulgaris*) and vetch were found by Dr. [Marie] Löhnis to be highly susceptible to manganese toxicity [ibid., xxvi, p. 372] and oats resistant, while strawberries were resistant to both excess and deficiency of the element.

Prof. Jamalainen reported the occurrence of boron, copper, and manganese deficiencies of crops in Finland. Sugar beet, swedes, apples, clover, celery, turnips, and white mustard are affected by boron deficiency. Copper deficiency is prevalent on peat and sand, and to a lesser degree on clay soils; cereals, hay, potatoes, and root crops all responded to copper treatments. Marsh spot of peas, due to manganese deficiency, occurred in Aland.

The paper sent by Dr. D. Mulder referred in particular to zinc deficiency in apples, pears, and cherries on highly calcareous sands in Zeeland, Holland. Summer or winter applications of zinc sulphate alleviate the condition.

Sugarcane smut disease. Problems of eradication.—*S. Afr. Sug. J.*, xxxi, 12, pp. 731–733, 1947.

Since the reappearance of sugar-cane smut [*Ustilago scitaminea*] in South Africa [*R.A.M.*, xxiv, p. 290], the Mount Edgecombe Experiment Station, Natal, has been in touch with neighbouring countries which also harbour the disease. The correspondence from these sources is now published for general information, with the exhortation to growers to make a careful inspection of their fields and take immediate steps to eradicate diseased stools, avoid planting cane from smutted stools, and, if necessary, disinfect cuttings before planting.

A letter from the Sena Sugar Estates, Portuguese East Africa [ibid., xxvi, p. 512], states that smut, to the best of the writer's belief, has always been present in the locality and was noted by him in Uba ratoons at Marromeu on his arrival in 1923. The Mopea estate sustained heavy damage from the disease from 1931 onwards, and one of the early P.O.J. canes (probably 213) was completely covered with the smut, necessitating its elimination from the nursery. Latterly up to 20 per cent. infection has been observed in some of the Uba fields on that estate. Since 1946 Co. 301 has been severely infected both at Mopea and the Sena Estates, and the discontinuance of its cultivation has been advised, since it is scarcely feasible to keep the disease under control by roguing out the infected stools. Co. 331 is much more resistant than Co. 301, but contracts a certain amount of infection, as in the case, for instance, of a field lying to windward of one of heavily contaminated Co. 301. However, by strict vigilance and the roguing of any smutted stools as they appear, the spread of smut in Co. 331 has so far been proved avoidable. As regards the other varieties grown locally, Co. 281 appears to be highly resistant, while no trace of smut has been detected in either Co. 290 or P.O.J. 2878. It has been reported during 1947 in Co. 408, 421, 453, and 464, but in no case were the symptoms severe. It is noteworthy that more infection has been found on new plantings at Mapangane than in old cane fields; the pathogen is known to be prevalent on several wild grasses, notably nut grass [? *Cyperus esculentus*], which no doubt act as reservoirs of the disease. Smut is invariably more prevalent in dry weather.

In a letter received during the week of writing (December, 1947), from the Incomati Estates, Xinavane, Portuguese East Africa, the canes chiefly grown in Natal and in the area of Mozambique under observation are grouped in the following order in respect of resistance to *U. scitaminea*, beginning with the least affected: (1) P.O.J. 2878, (2) P.O.J. 2725, (3) Co. 290, (4) Co. 281, (5) Uba, (6) Co. 301. The

two first-named are apparently immune and locally, at any rate, the disease is of no economic importance on (3) and (4). The remaining Uba canes are now practically all 'strays' along the edges of fields replanted with other varieties, and about six years ago the last stools of Co. 301 were removed on account of severe infection; the same practice is recommended for other areas where the disease is liable to be troublesome. In general, the character conferring resistance to smut appears to be hereditary, and N: Co. 310 was bred from varieties which have locally shown little tendency to withstand infection. No clear-cut symptoms have yet been observed on this variety, but suspicion has been aroused by apparent dwarfing and a little black powder on the foliage. The prolific and robust Co. 331 is considerably more resistant than Co. 301, but the quality of its juice is not up to the requisite standard for local cultivation.

Dr. [G. R.] Bates, Government Botanist to Southern Rhodesia, recently reported that smut continues to be the chief local problem [ibid., xxvii, p. 118]. Co. 281 is apparently less resistant than it was formerly believed to be, but generally the high resistance of Co. 290 is still maintained and P.O.J. 2725 and 2878 remain free from the disease.

Goidànich (G.) & Ruggieri (G.). **Un reperto di sistematica micologica di eccezionale interesse fitopatologico.** [A finding in systematic mycology of unusual phytopathological interest.]—Reprinted from *Ric. sci. Ricostruz.*, xvii, 7–8, 7 pp., 4 figs., 1947.

A study of Verrall and May's diagnosis of *Dothiorella ulmi* [*R.A.M.*, xvi, p. 782] discloses that the fungus is not a *Dothiorella*, since it does not produce acrogenous pycnoconidia on well-differentiated conidiophores and typical microconidia. Morphological researches by the same workers, by Goss and Frink [ibid., xiii, p. 478], and by Creager [ibid., xvi, p. 783] have demonstrated that the spores developed from the pycnidia and those from the vegetative hyphae are typical endoconidia like those of *Cadophora* rather than *Cephalosporium*.

Although Petri's work on *Deuterophoma tracheiphila* [ibid., x, p. 182; xxv, p. 498] indicates that it differs considerably from *Dothiorella ulmi*, a careful examination of the former has shown that these differences do not exist. Its pycnidia have an ostiole, often accompanied by a neck; its conidial fructification sometimes resembles that of a *Cephalosporium* and sometimes that of a *Cadophora* (*in sensu lato*); and pycnidiospores and conidia are endogenous. This evidence is sufficient to show that *D. ulmi* and *Deuterophoma tracheiphila* should be comprised in one and the same genus.

When a strain of *Dothiorella ulmi* obtained from Baarn was grown in parallel culture with *Deuterophoma tracheiphila*, the former failed to produce pycnidia, but the general appearance of the colonies, their manner of growth, and the morphology of the mycelium and conidia showed that there were striking resemblances between the two organisms.

For *Dothiorella ulmi* Verrall and May the authors propose 'pro tempore' the new combination *Deuterophoma ulmi* (Verrall & May) Goidànich & Ruggieri. Further work is in progress.

Goidànich (G.) & Ruggieri (G.). **Le Deuterophomaceae di Petri.** [Petri's Deuterophomaceae.]—*Ann. Sper. agr.*, N.S., i, 3, pp. 431–448, 2 figs., 1947. [English summary.]

The authors agree with Petri [*R.A.M.*, xiii, p. 474] that the Phomaceae should be divided into two families, the Euphomaceae (characterized by hymenopycnidia, the conidiophores constituting an hymenium) and the Deuterophomaceae (characterized by hystopycnidia, pycnoconidia being produced endogenously or exogenously, or by both processes, by the cells of the pseudoparenchyma which is

contained in the excipulum). The morphological characters of the Deuterophomaceae are fully described and discussed, and the conclusion is drawn that this group is fundamentally valid. It is suggested that in working out the taxonomy of the Deuterophomaceae due consideration should be given to all the characters that appear in the life-history of the species. Finally, the authors suggest two new sub-families, Peyronellaceae and Sclerophomaceae, and a new genus, *Deuterophomina*. The new genus is related to *Peyronellaea*, from which it is separated by the absence of alternarioid chlamydospores in the mycelium.

Bond (T. E. T.). **The 'phloem necrosis' virus disease of Tea in Ceylon. III. Further characterization of necrosis in the leaf.**—*Ann. appl. Biol.*, xxxiv, 4, pp. 517–526, 1 pl., 7 figs., 1947.

In this concluding paper of the present series [cf. *R.A.M.*, xxiv, p. 207] the author presents a detailed account of his studies on the histology of the leaf petioles and midribs of tea plants affected by phloem necrosis. Arising first in the protophloem, the condition may spread inwards to the metaphloem and outwards to and including the pericycle, the necrosis being accompanied by cell enlargement and the production of new thin-walled cells by hyperplasia. This condition is termed 'true necrosis' to distinguish it from the non-pathogenic 'false necrosis' of unknown origin, which originates typically in the metaphloem, but may display the same histological effects, except that hyperplasia is absent. In the petiole, the distinction between true and false necrosis on the basis of position as seen in a transverse section is comparatively easy and the continued use of this method of diagnosis is recommended. No such distinction can reliably be made from midrib sections where false necrosis is frequently found, like true necrosis, immediately within the pericycle, owing to the smaller total width of the phloem in the midrib as compared with the petiole.

In plants affected by true necrosis the condition does not usually become apparent until the primary vascular structure has nearly attained its full development. It appears first in the protophloem, which is then in an advanced state of obliteration. In its effects it resembles an acceleration of the normal process of obliteration, except that the crushed cells and their thickened walls become discoloured following the accumulation of a yellowish-brown, amorphous substance resembling wound gum. As necrosis proceeds obliteration affects more and more cells while others show a compensatory tendency to hypertrophy. This can be detected most easily by a careful comparison of equivalent necrotic and healthy sectors, with reference particularly to the groups of parenchyma cells associated with the ending of the several medullary rays. This phase of primary hypertrophy is of variable duration. Where the total incidence of necrosis is low, its effects on the individual cells are comparatively slight, hypertrophy is not usually pronounced, and the enlarged cells appear able to persist for a long time. At an intermediate level, the crushing effect appears to predominate with the result that the cells undergoing hypertrophy are quickly obliterated, the remains accumulating in a dense necrotic residue in which indistinct cell cavities may remain discernible for a brief time. The pericycle becomes increasingly affected and may locally be destroyed. Finally, in the most heavily necrotic bundles the giant cells become subdivided into pockets of thin-walled, variously arranged cells, which may further subdivide. It is solely this hyperplastic response which absolutely distinguishes true from false necrosis. It arises within or just inside the pericycle, and in the midrib it prevents normal lignification of that tissue. Very occasionally, it passes beyond the pericycle to a few cells of the adjoining starch sheath. The colourless hyperplastic tissue by its continued division tends to become surrounded by an accumulation of necrotic discoloured residues, so that in the final stage of the disorder there is not only an increase in the total width of the region affected, but

also a tendency for the necrosis itself to become discontinuous in its distribution or to be separated into distinct inner and outer zones. In the latter case, where the hyperplastic divisions are predominantly radial, there is a similarity to the effect normally produced in the stem by the early activity of the phellogen.

With false necrosis, the main histological effect is a thickening and yellowish-brown discoloration of the cell walls, chiefly of the ray parenchyma and adjacent phloem. Occasionally, the cell cavities may become blocked. Where the necrosis reaches the protophloem there are frequent indications of cells enlargement; the pericycle is scarcely affected.

Scott (W. A.). **Preliminary results on chemical seed and disease control in Tobacco plant beds.**—*Lighter* (*Dep. Agric. Can.*), xviii, 1, pp. 10–15, 1948. [Mimeographed.]

Although experiments in Ontario have shown that calcium cyanamide, used alone or with uramon, can successfully control weeds and black root rot of tobacco [*Thielaviopsis basicola*: *R.A.M.*, xxvi, p. 219], respectively, these materials should be used with caution until more is known regarding effective methods and rates of application, limits of their use, the length of reaction period necessary, and the effect on fertility balance and sprouted seed. Experiments on these lines have already been started.

Haslam (R. J.). **Two new varieties of Tobacco will be grown on a larger scale in 1948.**—*Lighter* (*Dep. Agric., Can.*), xviii, 1, p. 16, 1948.

Breeding and selection programmes at the Dominion Experimental Station, Harrow, Ontario, have yielded the Burley tobacco variety Harmony (Harrow 35) and the flue-cured Delcrest (D 2007), which are, respectively, highly and moderately resistant to black root rot [*Thielaviopsis basicola*: *R.A.M.*, xxvii, p. 65 and preceding abstract].

Crandall (B. S.) & Swingle (C. F.). **Studies of Tomato diseases in the Amazon basin of Peru (Preliminary report).**—*Proc. Amer. Soc. hort. Sci.*, xlix, pp. 267–269, 1947.

The information in this paper has already been noticed from another source [*R.A.M.*, xxvii, p. 164].

Kikuta (K.) & Frazier (W. A.). **Preliminary report on breeding Tomatoes for resistance to Tobacco mosaic virus.**—*Proc. Amer. Soc. hort. Sci.*, xlix, pp. 256–262, 2 figs., 1947.

Most of the information in this paper (published as *Tech. Pap. Hawaii agric. Exp. Sta.* 153) has already been abstracted from the Report [*R.A.M.*, xxvi, p. 535]. In addition to the tomato hybrids tolerant of the tobacco mosaic virus listed there, several segregates from a cross between HES–2269 and (*L. peruvianum* × Michigan State Forcing × *L. pimpinellifolium*) × *L. hirsutum* also showed a high degree of tolerance in inoculation tests.

Frazier (W. A.), Kikuta (K.), & Hendrix (J. W.). **Breeding Tomatoes for combined resistance to Fusarium wilt, spotted wilt, and gray leaf spot in Hawaii.**—*Proc. Amer. Soc. hort. Sci.*, xlix, pp. 235–240, 1947.

The data contained in this paper, published as *Tech. Pap. Hawaii agric. Exp. Sta.* 149, have already been noticed from another source [*R.A.M.*, xxvi, p. 534].

Coe (D. M.) & Altstatt (G. E.). **Big bud of Tomato found in central California.**—*Plant Dis. Reptr*, xxxi, 12, pp. 478–479, 1947. [Mimeographed.]

During 1947 a few tomato plants of the Pearson variety in San Joaquin county, California, were observed to have distorted, swollen buds and other symptoms characteristic of the tomato big bud virus [*R.A.M.*, xxvi, p. 135]. The plants were dwarfed and bushy, not more than one in a field being affected. Three previous records of the California Department of Agriculture all referred to the Pearson variety. An editorial note states that J. T. Middleton reported the disease in Riverside and San Diego Counties in 1940.

Miller (P. R.) & Wood (Jessie I.). **Tomato late blight in the warning service area in 1947.**—*Plant Dis. Reptr, Suppl.* 171, pp. 192–200, 1 diag., 5 maps, 1947. [Mimeographed.]

After stating that as a result of the unprecedented severity of tomato late blight (*Phytophthora infestans*) in the eastern region of the United States in 1946 [*R.A.M.*, xxvi, p. 176] a warning service was instituted, operated primarily by key pathologists in each co-operating State and in Canada [ibid., xxvi, p. 427], the authors present reports [the results of which are summarized in tabular form] on the development of the disease and the effectiveness of the control measures adopted during 1947 from the different parts of the area in the warning service. The main features of the outbreak were the early appearance and general establishment of the disease in Florida, the February frost that killed most of the potato and tomato plants in a great part of Florida and other southern States, the absence of infection of southern-grown plants (in contrast to the prominent part played by this source of inoculum in 1946), the restricted area of real damage (again in contrast to 1946), and the proved effectiveness of spraying and dusting.

Samson (R. W.). **Stemphylium solani on Tomatoes in Indiana.**—*Plant Dis. Reptr*, xxxii, 2, p. 51, 1948. [Mimeographed.]

Tomato grey leaf spot (*Stemphylium solani*) [*R.A.M.*, xxvi, p. 533] was identified in Indiana in the spring of 1947 on tomato seedlings from southern Georgia and in many fields. In some localities the disease caused severe defoliation, reducing yields by more than 40 per cent.

Hester (J. B.), Smith (G. E.), & Shelton (F. A.). **The relation of rainfall, soil type, and replaceable magnesium to deficiency symptoms.**—*Proc. Amer. Soc. hort. Sci.*, xlix, pp. 304–308, 1 fig., 1 graph, 1947.

In 1946, magnesium deficiency was common in New Jersey in tomato and sweet potato fields on sandy soils with less than 100 lb. replaceable magnesium per acre; none occurred in those with 132 lb. or more. Magnesium sulphate at 200 lb. per acre corrected the deficiency even after it became prevalent. Soils low in magnesium should be treated with a dolomitic liming material or a fertilizer containing about 2 per cent. magnesium.

Bretz (T. W.) & Tucker (C. M.). **Canker stain of London Plane in St. Louis, Missouri.**—*Plant Dis. Reptr*, xxxii, 2, pp. 65–66, 1948. [Mimeographed.]

The destructive canker stain of London plane (*Platanus acerifolia*), caused by *Endoconidiophora* sp. [allied to *Ceratostomella fimbriata*: *R.A.M.*, xxvii, p. 50], occurred in 1947 in two rather widely separated localities in the city of St. Louis. In one area out of 51 trees five died and 16 were infected; in the other of 25 trees nine died and six were diseased. All cankers appear to have originated from injuries. Isolations yielded *Endoconidiophora* sp. as well as perithecia characteristic

of *Ceratostomella*. Because of the extensive plantings of London plane tree in St. Louis, a large-scale control programme [loc. cit.] is recommended.

Cole (J. R.). **A comparison of home-made Bordeaux mixture with other fungicides for control of scab on the Schley and Moore varieties of Pecan.**—*Phytopathology*, xxxviii, 2, pp. 106–109, 1948.

Summarizing and tabulating his experiments, initiated in 1935, on the control of pecan scab (*Cladosporium effusum*) on the highly susceptible Schley variety in south Georgia [*R.A.M.*, xxiii, p. 346], the writer reports that four applications of Bordeaux mixture (6–2–100) consistently gave larger increases in yield over the unsprayed controls than did the various other fungicides tested. (The anomalous results in 1943, when the check trees were more productive than the treated, may have been due in part to their accidental inclusion in one of the applications, while another factor was the dry season, which stimulated the development of the host and retarded that of the pathogen.) The increases in yield of the Bordeaux-sprayed trees over the checks in 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1944, 1945, and 1946 amounted to 30, 55, 73, 37, 62, 34, 81, 62, 40, 20, and 27 lb. nuts per tree, respectively.

In a test in 1946 on the Moore variety in north Florida, both copper A [ibid., xxiii, pp. 262, 396; xxv, pp. 331, 558] and fermate, with and without Dupont spreader-sticker, gave larger increases in yield over the unsprayed controls than did Bordeaux alone; the use of the spreader-sticker improved the performance of the last-named. The average yields (in lb.) were 77, 87, 94, 92, 83, 83, and 55 for Bordeaux, the same plus Dupont, copper A, the same plus Dupont, fermate, the same plus Dupont, and controls, respectively. However, the course of the disease during the season, as well as the quality of the nuts, revealed no significant differences between the three fungicides, either with or without adjuvants.

Preston (A.) & McLennan (E[thel] I.). **The use of dyes in culture media for distinguishing brown and white wood-rotting fungi.**—*Ann. Bot., Lond.*, N.S., xii, 45, pp. 53–64, 1 pl., 3 graphs, 1948.

To enable a distinction in culture to be made between white and brown wood-destroying fungi [*R.A.M.*, xvi, p. 221], inocula from young cultures on 2·5 per cent. malt agar plates were transferred to slopes of malt agar plus gentian violet or neutral red at a 0·007 per cent. concentration, incubated for three weeks at 25° C., and examined at seven-day intervals. The medium was decolorized by the 31 white rot fungi tested but not by the 25 causing brown rot. To determine the colour of the rot produced *Eucalyptus regnans* blocks, 2 by 1 by 1 in., were partially embedded in 400 gm. autoclaved surface loam, inoculated at the surface of the soil with pieces of agar bearing mycelium of the test fungi, and incubated in screw-top jars at 24° for six months. *E. regnans* has pale-coloured wood which, when autoclaved with red, forest loam, becomes much darker; thus, any change in colour due to the wood-rotting fungus is easily detected, the brown rot group being comparable in colour with the controls while the white rot blocks appeared much paler.

The dye became completely decolorized only when the oxygen concentration above the medium exceeded 6 per cent.

Skolko (A. J.). **Deterioration of fire-killed pulp-wood stands in Eastern Canada.**—Reprinted from *For. Chron.*, xxiii, 2, 18 pp., 15 figs., 1947.

In order to investigate the rate of deterioration of timber with a view to salvage in burned-over areas following the 1941 fires in Eastern Canada, 1,400 trees on six plots were thoroughly examined in August of each year from 1942. Special attention was paid to (1) sap rot, (2) breakage (including that due to heart rot), and (3) windfall or uprooting. Sapwood decay in spruce was negligible, and breakages

caused by sapwood decay and heart rot were also very low even after five years, the rate of deterioration after severe or moderate burns being only 5·5 per cent. The very dry condition of the timber appeared to be unfavourable for fungal development. After the second year some pitted sap rot (*Polyporus* [*Polystictus*] *abietinus*) [*R.A.M.*, xxiii, p. 202] was observed. Most sapwood decay, however, was caused by the brown cubical rot (*Lenzites sepiaria*) [ibid., xxvi, p. 573], especially in the lower part of the trunk.

On the severely burned balsam [*Abies balsamea*] plots the rate of deterioration did not differ much from that of spruce, but moderately burned balsam deteriorated more rapidly, reaching over 42 per cent. by the end of the third year.

For jack pine [*Pinus banksiana*] with severe and moderate burns the rate of deterioration was very low. Although free from advanced decay, the sapwood became badly stained in the first year with red and blue radial streaks.

Harkom (J. F.) & Sedziak (H. P.). **Laboratory and service tests of pentachlorophenol and copper naphthenate as wood preservatives.** —*Mimeogr. For. Prod. Lab. Can.* 126, 11 pp., 2 figs., 1947.

In this progress report the results are given of work in which red pine [*Pinus resinosa*] wood blocks ($\frac{3}{4}$ in. cubes) treated with pentachlorophenol and copper naphthenate in petroleum and fuel oil solvents were tested for resistance to decay by *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, and *Lenzites sepiaria* in accelerated laboratory tests after passing through heating (one week at 52° or 100° C.) and leaching (one or two weeks in running water) cycles. The results showed that (*a*) less copper naphthenate than pentachlorophenol was removed from the treated blocks during the heating and leaching cycles, and (*b*) the blocks treated with copper naphthenate were not attacked after eight months except 6 out of 18 treated at the lower concentration ($\frac{1}{10}$ lb.) of the preservative in fuel oil and subjected to the higher temperature and longer leaching. Those treated with pentachlorophenol were less resistant. Service tests are in progress.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lviii, 12, pp. 645–648, 4 figs., 1947.

Hot-water treatment against *Xanthomonas campestris* and *Phoma lingam* on seed of cabbage, cauliflower, broccoli, Brussels sprouts, and turnip is recommended [cf. *R.A.M.*, xvii, p. 298; xxiv, p. 217], cabbage and turnip seed being treated for 25, and other crucifer seed for 18 minutes at 122° F. The seed should be tied loosely in cheese-cloth bags holding not more than about 4 oz. and a 3- or 4-gal. water-container used. After treatment the seed should be spread out in a warm, shady place to dry. If this treatment reduces germination [cf. ibid., xx, p. 507], alternatively the seed may be dipped in mercuric chloride solution (1 in 1,000) for 30 minutes. Seed submitted to either treatment should, after drying, be dusted with agrosan, ceresan, or semesan at the rate of $\frac{1}{4}$ to $\frac{1}{2}$ level teaspoonful per lb.

Notes are given on the control of cucurbit powdery mildew (*Erysiphe cichoracearum*) and downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) [ibid., xxiv, p. 263] by dusting and spraying, using sulphur on pumpkin, squash, and marrow, and Bordeaux mixture (3–4–40) or copper oxychloride on rockmelon and cucumber.

The bean [*Phaseolus vulgaris*] certification scheme, introduced mainly against bacterial blight [*Pseudomonas medicaginis* var. *phaseolicola*: ibid., xxiv, p. 172; xxv, p. 22; xxvi, p. 373], was continued in 1946–7, 964 acres being inspected and 545 passed for certification. Rather more than 6,000 bush. dressed seed were certified, of which 66 per cent. was Brown Beauty and 22 per cent. Hawkesbury Wonder. In future, the crops will be inspected only once, though in special cases two or more inspections will still be made.

Leach (L. D.). **Growth rates of host and pathogen as factors determining the severity of preemergence damping-off.**—*J. agric. Res.* lxxv, 5–6, pp. 161–179, 12 graphs, 1947.

In experiments carried out at the California Agricultural Experiment Station to determine the effect of temperature on the severity of pre-emergence damping-off [*R.A.M.*, xxvi, pp. 378, 573] seeds of spinach, sugar beet, pea, and watermelon were germinated in pasteurized soil infested with damping-off fungi and maintained at controlled moisture contents and temperatures. Daily emergence counts made in pasteurized soil at each temperature determined the co-efficient of velocity of emergence for each host, while the growth rate of each pathogen at each temperature was measured on agar plates or in nutrient solutions. In soil infested with *Pythium ultimum* spinach was most severely infected from 12° to 20° C. but escaped pre-emergence infection at 4°, while in soil infested with *Rhizoctonia* [*Corticium*] *solani* infection was most severe above 20° and negligible below 12°. Watermelon infection by either pathogen increased as the temperature decreased below 35°. Garden peas suffered most from seed decay and damping-off between 12° and 25° in *P. ultimum*-infested soil. Sugar beets showed most infection from *P. ultimum* between 12° and 20°, from *C. solani* between 16° and 30°, and from seed infected with *Phoma betae* [ibid., xxvii, p. 3] at 4° to 20°. All host and pathogen combinations showed that pre-emergence infection was most severe at temperatures relatively less favourable to the host than to the pathogen according to the ratio of their growth rates. The lower the ratio the more severe was the damping-off. It appears, therefore, that the relative growth rates of the host and pathogen determine to a considerable degree the severity of pre-emergence infection at different temperatures.

McLean (D. M.). **Alternaria blight and seed infection a cause of low germination in certain Radish seed crops.**—*J. agric. Res.*, lxxv, 2, pp. 71–79, 4 figs., 1947.

Of four *Alternaria* spp. isolated from low-germinating radish seed in Michigan in 1945, *A. raphani* [*R.A.M.*, xxv, p. 204; xxvi, p. 405] was most commonly found and believed to be the cause of the field infection. This species is pathogenic to seedlings and also causes infections of leaves, stems, pods, and roots. Infections produced by inoculations with *A. raphani* appear first on the cauline leaves as yellowish, raised spots 1 mm. in diameter, increasing with age to approximately 1 cm., when they are spherical to elliptical with thin, translucent, papery centres and slightly raised borders, and are usually accompanied by the dark growth of the fruiting fungus. The centres of old lesions sometimes fall out, giving a shot-holed appearance. Sporulation is generally most abundant on the foliar lesions. Early symptoms appear on the pods and stems as purple to brown, irregular lesions which increase in number until, when mature, the pods are covered with blackish lesions varying in size from a pin-point to over 1 cm. In wet seasons the whole pod may be black. Similar lesions occur on the stems and occasionally the exposed parts of the root crown. When young pods are severely infected the seeds may not develop; in older pods they are shrivelled and dark. The disease may prevent germination or induce pre- or post-emergence damping-off of seedlings.

A. brassicae and *A. oleracea* [*A. brassicicola*] were rarely found and are probably only of secondary importance in causing low seed germination. *A. tenuis*, although common on radish seeds, is probably mainly saprophytic.

Subjecting infected seeds to treatment for 25 minutes at 50° C. killed the pathogen but failed to increase germination in low-germinating seed lots.

Severin (H. H. P.). **Location of curly-top virus in the Beet leafhopper, Eutettix tenellus.**—*Hilgardia*, xvii, 17, pp. 545–551, 3 figs., 1947.

Non-infective beet leafhoppers (*Eutettix tenellus*) [*R.A.M.*, xvii, p. 497] fed on

solutions containing crushed stomach, salivary glands, saliva, and blood from infective leafhoppers, and on filtrates prepared from these organs, transmitted beet curly top virus to healthy beet seedlings. Negative results were obtained with ovaries from infective female leafhoppers. When infective insects injected saliva into a feeding solution the virus was recovered from it by previously non-infective leafhoppers and transferred to beet seedlings.

Severin (H. H. P.) & Drake (R. M.). **Weeds experimentally infected with beet-mosaic virus.**—*Hilgardia*, xvii, 17, pp. 569–576, 2 pl., 1947.

At the California Agricultural Experiment Station, bractscale (*Atriplex bracteosa*), red orache or redscale (*A. rosea*), spear orache or spearscale (*A. patula* var. *hastata*), lamb's-quarters or white pigweed (*Chenopodium album*), sowbane or nettle-leaf goosefoot (*C. murale*), and Russian thistle (*Salsola kali* var. *tenuifolia*) were infected by mechanical inoculation with sugar beet mosaic virus extract [*R.A.M.*, xxvii, p. 270]. All the weeds showed systemic infection and the virus was recovered from each species.

Severin (H. H. P.) & Little (D. H.). **Spinach yellow dwarf.**—*Hilgardia*, xvii, 17, pp. 555–566, 2 pl., 1947.

The spinach yellow dwarf virus was detected on spinach plants near San Pablo, California. The first visible symptoms are clearing of the veinlets and curvature of the midrib. The younger leaves then become conspicuously mottled with yellow and green, curled and puckered, with blister-like elevations and curved petioles. The older leaves show numerous small, chlorotic areas which later coalesce and form conspicuous, yellow blotches. A necrosis follows, usually starting at the basal margin and progressing to include the whole leaf. The heart is stunted and after the outer leaves have died it becomes yellow and dies. The first symptoms develop 12 to 14 days after inoculation in the greenhouse and 25 to 35 days out-of-doors (during winter). The host range of the virus is limited to spinach and the following varieties have been infected experimentally: Broad Flanders, Giant Thick Leaved, Juliana, King of Denmark, Long Standing Bloomsdale, Prickly Seeded Dark Green, Savoy Leaved or Bloomsdale, Thick Leaved Nobel, Virginia Savoy, and Viroflay.

The virus in sap was inactivated at 55° C. in 10-minute exposures but not when kept at −18° C. for six months. It was also inactivated by exposure to the air at room temperature for eight days. The tolerance to dilution was 1 to 20,000.

The green peach aphid, *Myzus persicae*, was found to be the vector. Two of 25 previously non-infective wingless aphids fed for five minutes on a diseased plant and then for five on a healthy one transmitted the virus. Infections obtained by lots of 20 aphids averaged 40 per cent., and by mechanical inoculation with extracts from each diseased plant on which the aphids had fed, 76 per cent. Aphids transmitted the virus only during one day, no infection occurring during or after the second. Exposed hourly to healthy plants for a period of 10 hours, five lots of 20 infective aphids transmitted the virus to five plants during the first hour, two during the second, and none thereafter.

Roland (G.). **La transmission du virus de la jaunisse de la Betterave par la semence.** [Seed transmission of Beet yellows virus.]—*Parasitica*, iv, 1, p. 30, 1948.

Until quite recently beet yellows virus [*R.A.M.*, xxvii, pp. 106, 169] was considered to be non-transmissible by the seed. In the course of a preliminary experiment made about ten years ago in an isolated greenhouse with seeds obtained from seed forage beets attacked by yellows, only one diseased plant out of 32 was obtained, this probably being due to accidental infection. The case of seed transmission recently observed by Clinch *et al.* [ibid., xxvii, p. 211] may be unique,

although there is a possibility that it may be due to an hereditary factor permitting transmission, the action of which, among beets bearing it in their genotype, might be explained by the non-production of a virus-inhibiting substance in the seed. This explanation would only be valid, however, if the virus were present in the fertile ovary. In conclusion, the author stresses the need for further study of the virus to determine whether it can normally be transmitted through the seed, and in what proportion. Even if the rate of seed transmission were found to be 0·1 per cent., this should be quite sufficient to infect a whole planting, reckoning 10,000 beets and six possible virus foci per ha.

Baker (K. F.). **Seed transmission of Rhizoctonia solani in relation to control of seedling damping-off.**—*Phytopathology*, xxxvii, 12, pp. 912–924, 2 figs., 1947.

The following information is presented in extension of a previous abstract on seed transmission of *Rhizoctonia* [*Corticium*] *solani* in chilli pepper in relation to damping-off control in southern California [*R.A.M.*, xxvi, p. 526]. The regions of the seed showing invasion by the mycelium include the attached remnants of the funicule, the inner layers of the seed coat, the endosperm, and the embryo itself, especially at the tip of the radicle. A similar mode of perpetuation was observed locally in tomato, eggplant, and *Zinnia elegans*, and has previously been reported in bean [*Phaseolus vulgaris*: ibid., xxiii, p. 328], pea [ibid., xvi, p. 435], hairy vetch [*Vicia villosa*: ibid., xix, p. 225], groundnut, subterranean clover [ibid., xxii, p. 68], spinach, and Japanese hop [*Humulus japonicus*].

By means of soil pasteurization and seed treatment with hot water, combined with rational cultural practices, methods for the greenhouse cultivation of seedlings have been improved along the lines of more dependable and rapid production of superior plants, thus economizing in space, labour, and expense, and reducing the risk of carrying contamination to the field.

Nusbaum (C. J.). **A summary of Cucurbit downy mildew reports from Atlantic coastal States in 1947.**—*Plant Dis. Reptr*, xxxii, 2, pp. 44–48, 1948. [Mimeographed.]

The reporting service on cucurbit downy mildew (*Pseudoperonospora cubensis*) [*R.A.M.*, xxiii, p. 423; xxvii, p. 215], conducted for the seventh consecutive season, showed some improvement in 1947. Twenty-six reports from nine States (Florida to Massachusetts) were co-ordinated by the author and copies sent to the collaborators, thus giving them all available information about the progressive northward spread of the disease. Workers at Blackville, South Carolina, in Delaware and Massachusetts, and possibly at other stations were able to anticipate accurately its arrival; Delaware distributed warning circulars in advance.

As in previous years the disease, which causes considerable damage, was established early in the coastal areas and appeared to spread farther inland than usual, especially in Virginia, Pennsylvania, and upper New York State.

Stoddard (D. L.). **Nitrogen, potassium, and calcium in relation to Fusarium wilt of Muskmelon.**—*Phytopathology*, xxxvii, 12, pp. 875–883, 1 diag., 1947.

Muskmelon wilt (*Fusarium bulbigenum* var. *niveum*. f. 2) [*R.A.M.*, xxvi, p. 218] has been reported from a number of areas producing the crop in the United States, including Maryland, where the author's studies on the relation of nutrition to its occurrence were conducted. Observations made in the course of greenhouse and field experiments indicated that high nitrogen levels enhance the predisposition of the plants to infection. For instance, in one greenhouse test the number of plants killed rose from 10 with 100 p.p.m. nitrate to 26 with 744 in the nutrient solution, while in another the mean disease rating per plant in a scale ranging from 0 (healthy) to 20 (entire plant dead) was 5·8 at the former level and 11·7 at the latter.

The addition of sufficient lime to the soil to raise the pH to 6 significantly reduced the amount of wilt in the field plots, the mean disease rating per limed plot in five fertilizer ratios, viz., 6–6–5, 4–8–8, 4–8–12, 4–8–16, and 4–8–20, being 3·95 as compared with 5·63 in the unlimed. Neither in laboratory nor in field tests did any marked correlation appear between the development of *F. bulbigenum* var. *niveum* f. 2 and the potassium supply.

Kligman (A. M.) **The Truffle problem.**—*Bull. Mushroom Gr. Ass.* 11, pp. 73–78, 1948.

This account collates, in popular terms, all the available information regarding the truffle disease of cultivated mushrooms [*Pseudobalsamia microspora*: *R.A.M.*, xxiii, p. 425; xxvii, p. 216].

Edwards (R. L.) & La Touche (C. J.). **Hygiene on the Mushroom farm.**—*Bull. Mushroom Gr. Ass.* 11, pp. 88–92, 1948.

As a guard against mushroom diseases, methods for ensuring hygienic conditions in the turning and casing-soil sheds, in and around mushroom houses, and amongst straw, compost, casing soil, and equipment are listed, together with measures for dealing with diseased mushrooms and their remains, bed contaminants, and insects and other pests.

Clayton (C. N.). **Effect of several seed protectants on emergence and stand of Okra.**—*Phytopathology*, xxxviii, 2, pp. 102–105, 1948.

At the South Carolina Truck Experiment Station, the treatment of Clemson Spineless and other varieties of okra [*Hibiscus esculentus*] either with new improved ceresan or spergon resulted in a significant increase in stand in each of five tests. In one of these the average number of plants emerging from 100 seeds in a 10- to 12-ft. long row was 82·6 and 74·4, respectively, for new improved ceresan and spergon (dosage of 0·25 per cent.), and 76·6, 75·4, and 70·4, respectively, for arasan, fermate, and 2 per cent. ceresan at the same rate, as against 68·6 untreated. In another test the corresponding percentages were 52·2, 57·2, 56, 48·8, and 52·6, compared with 38·6 for the control. The best results were obtained with new improved ceresan and arasan at 4 oz. per 100 lb. seed and spergon at 16 oz. A number of other materials tested proved less effective for the purpose in view. Several hours' immersion of the seed in water prior to sowing caused a decrease in the stand.

De Melo (J. L.). **A ocorrência de Albugo ipomoeae panduratae (Schw.) Swingle in Pernambuco.** [The occurrence of *Albugo ipomoeae panduratae* (Schw.) Swingle in Pernambuco.]—*Bol. Agric., Pernambuco*, xiv, 4, pp. 332–336, 3 figs., 1947.

Sweet potato leaves attacked by *Albugo* [*Cystopus*] *ipomoeae-panduratae* [*R.A.M.*, viii, p. 11] in Pernambuco, Brazil, bear white, discrete or aggregated pustules and develop hypertrophy and hyperplasia of the tissues. The morphology of the fungus is briefly described. Detached leaves of five varieties were placed in 60 Petri dishes (one leaf per dish) and inoculated with zoospore suspensions from a pure culture of the pathogen. A total of eight leaves contracted infection, namely, five of Ligeira Branca, two of Rainha Branca, and one of Pixaim, while Dahomey and Gerimú were not attacked.

Vital (A.). **Notas sôbre Meliola pontualii n. sp.** [Notes on *Meliola pontualii* n. sp.] —*Bol. Agric., Pernambuco*, xiv, 4, pp. 337–340, 6 figs., 1947.

Ipomoea pes-caprae, used in Pernambuco, Brazil, for hybridization experiments with sweet potato, was found by Dr. D. Pontual to be infected by a hitherto

undescribed sooty mould, which is named *Meliola pontualii* and briefly described [without a Latin diagnosis]. It is characterized by profusely branching, septate hyphae, 7·5 μ in diameter; spherical hyphopodia, 12·5 μ; simple, erect, septate mycelial and perithecial setae, 200 to 230 by 7·5 μ; black, globose perithecia, 143 to 195 μ in diameter, occurring singly or in groups of three to five; more or less elliptical, aparaphysate, apedicellate asci, 45 to 65 by 27·5 to 30 μ, each containing four phaeophragmous, simple, cylindrical, slightly curved, smooth, thin-walled ascospores, with four distinct transverse septa, 30 to 40 by 10 to 12·5 μ.

Plants growing in full sunlight in the experimental plots sustained no injury from *M. pontualii*, but elsewhere the damage ranged from 10 to 15 per cent.

GALET (P.). **Résistance des porte-greffes à la chlorose.** [The resistance of Vine stocks to chlorosis.]—*Progr. agric. vitic.*, cxxviii, 36, pp. 128–133, 1947.

After pointing out that the American vines and their hybrids on which European vines are grafted are less resistant to lime-induced chlorosis [*R.A.M.*, xix, p. 193; xxiv, p. 112] than European vines, the author describes an improved method for estimating the chlorosis-inducing potency of soils. The soil is dried at 105° C. to constant weight, passed through a 1-mm. sieve, and 2·5 gm. is shaken mechanically for two hours with 250 c.c. N/5 ammonium oxalate. It is then filtered, the first few c.c. of the filtrate being rejected, and 20 c.c. of the filtrate, with 100 c.c. distilled water and 5 c.c. concentrated sulphuric acid, are titrated against N/5 potassium permanganate, n being the value obtained. The oxalate solution is titrated in the same way, and if the two fluids are perfectly adjusted N = 20 c.c. Then the percentage of active lime in the soil is $(N-n)\times 5$. Theoretically, the resultant figure ranges from 0 to 100.

A table is given showing the lime-content figures at which different vine varieties (*a*) remain green, (*b*) turn yellow, together with some probable threshold values. Brief notes are given on the degree of resistance shown, the Riparia-Berlandieri group being the most resistant, particularly 161–49 C, which can withstand up to 25 per cent. active lime. The paper concludes with a table showing the lime contents (total and active) of the various calcareous soils in France.

The 'court-noue' of the Vines.—*Food & Agric.*, *1947*, 2, p. 141, 1947.

In June, 1947, the International Office of Wine (IOV) organized in Paris a seminar on vine court-noué, the steady advance of which has aroused fears of a real crisis. In the report adopted by the Steering Committee of the IOV (1st to 2nd July, 1947) and submitted to the third Reunion of European National Committees of the F.A.O. it is stated that in view of the confusion arising between the external and internal symptoms of this disorder and other vine diseases, the name court-noué should be restricted to designate one disease only, or, better still, that it be replaced by the term 'infectious degeneration' [*R.A.M.*, xxvii, pp. 62, 172]. This disease has been referred to in the literature as court-noué, arricciamento (in Italy, on *V*[*itis*] *vinifera*), roncet (in Italy, on American vine [*V. americana*]), and Reisigkrankheit (Germany). It differs from conditions, also termed court-noué, which are caused by cold, subterranean organisms (*Phylloxera* [*vitifoliae*] or *Erwinia vitivora* [ibid., xxvi, p. 332]). Its external symptoms have been described by Pantanelli, while the final stage of withering has been dealt with by Ravaz [ibid., ix, pp. 360, 761].

The importance of the disease justifies increased research on the problem, particularly with regard to transmission, varietal resistance, serological studies, the role of hormones in inducing symptoms, and the diagnostic method based on the presence of endocellular cordons [cf. ibid., ix, p. 83; xvi, p. 795].

MATTHEWS (R. E. F.). **Plant virus proteins and antibody-antigen reactions.**—*Nature, Lond.*, clxi, 4094, pp. 611–612, 3 graphs, 1948.

This paper deals with investigations into the production of antisera in rabbits (Boyd's method) [*J. exp. Med.*, lxxiv, p. 369, 1941] by the injection of various doses of turnip yellow mosaic virus [*R.A.M.*, xxv, p. 284] alone and when mixed with tobacco mosaic virus. Rod-shaped plant viruses give a flocculent H-type precipitate, whereas spherical ones give a dense, granular O-type [ibid., xxiv, p. 137]. The results showed that the antibodies produced in the rabbit are specific for the individual proteins of the mixture injected, and that in the *in vitro* reaction the two systems precipitate independently, except under conditions where the precipitation times for both are about the same.

BREMER (H.), İŞMEN (H.), KAREL (G.), ÖZKAN (H.), & ÖZKAN (M.). **Beiträge zur Kenntnis der parasitischen Pilze der Türkei. Teil III.** [Contributions to the knowledge of the parasitic fungi of Turkey. Part III.]—*Rev. Fac. Sci. Univ. Istanbul*, Ser. B, xiii, 1, pp. 1–53, 10 figs., 2 graphs, 1948. [Turkish summary.]

This further instalment of the authors' list of Turkish parasitic fungi [cf. *R.A.M.*, xxvii, p. 114] includes the following records. *Macrophoma dalmatica*, not hitherto reported from Turkey, was collected on fallen olives [ibid., xxv, p. 508] in western Anatolia. *Deuterophoma tracheiphila* [see above, p. 338] is prevalent and destructive in the lemon groves on the south coast of Anatolia [ibid., xxv, p. 544]. *Ascochyta graminicola* [ibid., xxv, p. 155] was found on barley and oats in the Izmir district. Winter broad bean and pea crops in the same region sustain appreciable damage by *A. pinodella* [ibid., xxv, p. 255]. *A. pisi* is widespread on the same legumes. *Diplodina passerinii* was observed on *Antirrhinum majus* [ibid., xx, p. 467] at Izmir, this being the first record of the pathogen in the Near East. In the same locality celery is constantly infected by *Septoria apii*, while *S. petroselini* has been found on parsley [ibid., xxiv, p. 476] both at Izmir and Ankara. *S. tritici* is very widely distributed on wheat, but causes little damage owing to the early cessation of its development during the normally hot and dry summers and the marked recuperative powers of the host. The fungus was shown by inoculation experiments, however, to be a true parasite, attacking with particular severity the fully turgescent, green leaves of plants in the six- to nine-leaf stage [cf. ibid., xvi, p. 20 *et passim*]. Of 15 varieties tested for their reaction to *S. tritici*, Elbistan and Eskischir 305 remained immune and several others contracted barely a trace of infection. On a number of standard media the fungus formed mucous tubercles, ½ mm. in diameter, consisting for the most part of spores, which are produced directly on the mycelium, pycnidia being absent. Sprague likewise reports [ibid., xxv, p. 345] the formation of 'yeast-like colonies' in pure culture.

Gloeosporium ampelophagum [*Elsinoe ampelina*] is prevalent in the vineyards round Izmir and Manisa, where it caused 70 to 100 per cent. infection in the damp spring of 1940. *Marssonina panattoniana*, not hitherto recorded in the Near East [ibid., xxv, p. 96], occurs annually on *Lactuca scariola* [ibid., xx, p. 191] near Ankara, and was collected on chicory at Adana in 1943. The distribution of *Septogloeum mori* on black and white mulberries [ibid., xxvi, p. 551] is co-extensive with that of the host in Turkey.

Botrytis fabae has been observed on broad beans [ibid., xxvi, pp. 110, 523] at Izmir and Adana. *Rhynchosporium secalis* [ibid., xxvi, p. 493] is widely distributed on barley, especially in districts with a mild winter climate, as also reported by Caldwell for the United States [ibid., xvii, p. 22]. It was also collected on rye at Ankara in abnormally wet weather during May 1946. According to Wollenweber (in Sorauer's 'Handbuch der Pflanzenkrankheiten', 5th edition, 1932) [ibid., xi, p. 527], the conidia of *Piricularia oryzae* measure 20 to 22 by 10 to 12 μ and those

of *P. grisea* [ibid., xxiv, p. 7] 18 to 24 by 7 to 9 μ. In the authors' isolates from rice the corresponding dimensions were 21 to 34 by 7 to 13 and 19 to 33 by 8·5 to 11 μ on two separate occasions. The conidia of the Turkish material are biseptate, a point of resemblance with *P. oryzae*, but on the other hand, their apiculate bases are more suggestive of *P. grisea*. These data do not support the view that the two species are distinct. Wollenweber records a loss of viability in the conidia of *P. oryzae* after seven months, but 50 per cent. of the specimens collected by the writers and placed in the herbarium in September, 1938, germinated in January, 1942. The conidia of *Cercosporella brassicae* [ibid., xxii, p. 461] on *Raphanus raphanistrum* measured on an average 42 to 133 by 3 to 7 μ, on radish 54 to 118 by 3 μ, and on mustard 60 to 123 by 3·5 to 4·5 μ. This is another new record for the Near East. *Ramularia cynarae* is ubiquitous on artichokes (*Cynara scolymus*) [ibid., xxvi, p. 9] along the Mediterranean coast of Turkey. *Thielaviopsis basicola* was found only once causing root-rot of greenhouse cotton plants [ibid., xxii, p. 21] at Izmir in the winter of 1939 to 1940. Decaying cotton bolls in the province of Aydin harboured *Nigrospora sphaerica*. Wheat was infected by *N. oryzae* [ibid., xxvi, p. 388]. *Fusicladium depressum* var. *petroselini* occurred on parsley at Izmir [ibid., xvi, p. 493]. Clover was attacked by *Polythrincium* [*Cymadothea*] *trifolii*.

Clasterosporium carpophilum is prevalent throughout the country on *Prunus* spp., though causing heavy damage only under conditions of extreme atmospheric humidity, e.g., in valleys surrounded by mountains, in one of which, near Izmir, 90 per cent. of the buds of peach-trees were destroyed during the winter, whereas in neighbouring open situations the incidence was negligible. The extensive defoliation of almond-trees in April 1940 was shown by experiments on detached leaves to be associated with increased transpiration, the exact relation of which to the activity of the fungus merits further investigation. The control of the disease in the Izmir district presents great difficulties owing to the frequency of precipitation and the consequent risk of rapid washing-off of the spray deposit. The most practical solution appears to lie in the application of a highly concentrated 'reserve' spray during the dormant period, and on 26th and 27th January, 1940, five out of seven large almond-trees were treated with Bordeaux mixture (two at 2, two at 4, and one at 6 per cent.). On 17th April the incidence of shot hole on the sprayed trees was 20·5 and 52·8, 13·8 and 4·3, and 4·3 per cent., respectively, for the three concentrations, compared with 80·9 and 85·6 per cent. for the two untreated. It is apparent from these data that even the stronger 'reserve' sprays require to be supplemented by further treatments at lower concentrations.

Helminthosporium [*Pyrenophora*] *avenae* and *H. turcicum* were observed on oats and maize, respectively. *Cercospora beticola* occurred to a limited extent on fodder beets at Izmir and Ankara, and has also been collected on the wild *Beta trigyna*. *C. circumscissa* is very injurious to almonds [ibid., xxi, p. 99] at Adana. *C. longissima* [ibid., xiv, p. 472; xxiii, p. 428] was collected on chicory at Ankara. *C. zonata* was found on broad bean [ibid., xxiv, p. 388] and *Vicia narbonensis*, the latter stated to be a new host. On broad bean the conidia measure on an average 146·4 by 5·5 μ and on *V. narbonensis* 21 to 127 by 3 to 4·5 μ; in neither case do they correspond with the diagnosis of the species, approximating more closely, in fact, to that of *C. fabae* [ibid., xiii, p. 681]. It appears, however, from Natrass's studies in Cyprus [ibid., xvii, p. 346] that the two species are merely different stages of a single fungus, in which case the older name of *C. zonata* should be given priority.

Heterosporium variabile occurs regularly at Ankara on perpetual spinach [ibid., xxv, p. 569]. *Spondylocladium atrovirens* was detected on potatoes purchased at Izmir in 1938 and probably originating in south-west Anatolia. The two foregoing are new records for the Near East. *Alternaria cichorii* develops annually on safflower at the Ankara Agricultural College. The conidia of the authors' specimens measured 38 to 97 by 12 to 27 (mean 7·0 by 15) μ, exclusive of the beak, compared

with Nattrass's dimensions for the same species on chicory [ibid., xvii, p. 346] of 60 to 130 by 14 to 20 μ, 48·5 to 91 by 11 to 19 (70 by 15) μ for an isolate from *Plantago major* at Ankara, and 19·5 to 90 by 9 to 28·5 (56 by 17) μ for *A. zinniae* according to Neergaard [ibid., xxv, p. 581]. *Datura metel* at Adana was attacked by a fungus provisionally referred to *A. cookei* n. comb. (syn. *Macrosporium cookei* [? *A. crassa*]). *A. dianthi* was found infecting *Saponaria officinalis* [ibid., xxv, p. 580] at Ankara. *Stemphylium sarciniforme* [ibid., xx, p. 307; xxvi, p. 206] is believed to have been responsible for a leaf spot of *Ononis natrix* at Adana. The dark brown to black conidia on this host measured 15·5 to 33 by 13 to 28 (24·5 by 20·6) μ and those on *Trifolium* sp. at Izmir 24 to 36 by 12 to 17 (31·5 by 15·3) μ. The species does not appear to have been previously reported from the Near East. *Isariopsis griseola*, the agent of a bean (*Phaseolus vulgaris*) leaf and pod spot, seems to be of little economic importance [ibid., xxvi, p. 371].

Rhizoctonia crocorum [*Helicobasidium purpureum*] is reported to be widely distributed on sugar beets.

Dyer (R. A.). **Investigation of plant diseases, and botanical surveys.**—*Fmg S. Afr.*, xxii, 261, pp. 1082–1085, 1125, 1947.

The following items occur in the plant pathology section of the Annual Report of the Department of Agriculture, South Africa, for the year ended 31st August, 1947 [cf. *R.A.M.*, xxvi, p. 331]. Citrus black spot (*Phoma citricarpa*) [ibid., xxvi, p. 152], formerly known to occur in Pietermaritzburg, Richmond, the Umkomaas Valley, and along the north coast areas, now seems to be spreading rapidly, even in dry areas, heavy infection having been found at Tzaneen (Transvaal), Muden, Otto's Bluff, Pietermaritzburg, Umkomaas Valley, and along the north coast of Natal. It was present to a slight extent at Rustenburg and Barberton (Transvaal). Not only have severe losses been sustained in the orchards, but the disease has also developed in transit. Thousands of cases, hand-sorted at Tzaneen to exclude infected fruits, had to be rejected at Cape Town. Spraying with Bordeaux mixture (2–2–80) gave good control but caused slight injury to the trees.

The importance of proper irrigation and of maintaining soil nitrogen at a sufficient level for the control of *Diplodia* gummosis [*D. natalensis*: ibid., xxii, p. 19] was again demonstrated.

Barley was found to be highly susceptible to the [maize] streak [virus] affecting maize and wheat [ibid., xxvi, p. 331]; rye and, particularly, oats were much more resistant. Of the pasture grasses, teff [*Poa abyssinica*] is very susceptible, while 'babala' [*Pennisetum spicatum*], red grass [*Rhynchelytrum roseum*], and Sudan grass appear to be immune. Experiments to induce resistance in the local commercial maize varieties are giving promising results. False smut of Kaffir corn [*Sorghum vulgare*], associated with *Cerebella sorghi-vulgaris* [*C. volkensii*: ibid., viii, p. 355; xviii, p. 57], was recorded for the first time in the Union.

In 1946 and the beginning of 1947 several instances of natural infection of lettuce by kromnek were noted in Pretoria, clearly showing that kromnek is identical with the [tomato] spotted wilt found in other countries [cf. ibid., xxiv, p. 439; xxvii, p. 163].

Among seedling potato lines obtained from overseas promising varieties were found with resistance to *Phytophthora* [*infestans*] and wart disease (*Synchytrium endobioticum*). One line from the Empire Potato Collection was very resistant to *Alternaria solani*. Wart disease was found on the town lands of Belfast, Carolina, Hendrina, and Ermelo [ibid., xxvi, p. 332]; the usual quarantine measures were applied.

Two new tomato varieties, Durbot and a selection raised at the Research Station, Nelspruit, are highly resistant to *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: ibid., xxvi, p. 473]. The resistance of Marvel has broken down [ibid., xx, p. 150].

Losses of transplanted papaw seedlings from infection by members of the Pythiaceae were considerably reduced by arranging for the transplating to be in April and May, when the soil is cool. Mixed crops of maize and cucurbits gave promising results against cucurbit mosaic [? cucumber mosaic virus]. A disease resembling the sweet potato virus affection in East Africa [ibid., xxvi, p. 236; xxvii, p. 224] and proved to be transmissible by grafting was observed near Nelspruit and between Brits and Rustenburg. A cabbage and cauliflower disease, probably of minor importance, characterized by black rings and spots on the older leaves was present at Onderstepoort. Transmission tests to differential hosts identified the condition with the virus disease described elsewhere as cabbage ring spot and cabbage black spot [ibid., xxiv, p. 42; xxv, p. 54].

Citrus nursery stock quarantine (quarantine No. 19). Hawaiian Citrus nursery stock quarantine (quarantine No. 75). Citrus fruit quarantine (quarantine No. 28).—*B.E.P.Q., U.S. Dep. Agric.*, 6 pp., 1947.

The present revision of Quarantine No. 19, effective as from 15th September, 1947, and superseding that of 17th August, 1934 [*R.A.M.*, xiv, p. 64], is designed to prevent the entry into the continental United States, Puerto Rico, and Hawaii of plants of the family Rutaceae that have been found susceptible to citrus canker (*Xanthomonas citri*). It accordingly prohibits the importation into those territories of plants or any part thereof, except fruit and seeds, of all genera, species, and varieties of the sub-families Aurantioideae, Rutoideae, and Toddalioideae of the family Rutaceae from Europe, Asia, Africa, South America, Central America, North America outside of the United States, Australia, and foreign oceanic countries and islands.

Quarantine No. 75, effective as from 15th September, 1947, is issued for the purpose of preventing the spread of citrus canker from Hawaii, where it has been found to occur [C.M.I. Map 11], to the mainland of the United States. The quarantine accordingly prohibits the movement of the above-mentioned plant material from Hawaii to any other State, Territory, or District of the United States.

Quarantine No. 28, effective as from 25th October, 1947, and suspending the citrus fruit quarantine of 27th June, 1917, prohibits the importation into the continental United States, Puerto Rico, and Hawaii on account of (1) citrus canker: fruits and peel of all genera, species, and varieties of the sub-families Aurantioideae, Rutoideae, and Toddalioideae of the family Rutaceae from India, Burma, Ceylon, Siam, Indo-China, and China, Malayan Archipelago, Philippine Islands, Oceania (except Australia and Tasmania), Japan (including Formosa and other adjacent islands), Mauritius, Mozambique, and Seychelles; (2) sweet orange scab (*Elsinoe australis*): fruits and peel of lime, sour orange, Mauritius papeda [*Citrus hystrix*], lemon, grapefruit, mandarin orange, sweet orange, and oval kumquat [*Fortunella margarita*] from Argentina, Brazil [*R.A.M.*, xxvi, p. 304], Paraguay, and Uruguay; and (3) cancrosis B, a bacterial disease: fruits and peel of lime, sour orange, lemon, citron, and sweet orange from Argentina, Paraguay, and Uruguay.

Plant quarantine import restrictions, Iran.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 168, pp. 51–54, 1947.

A Ministerial Decree of 2nd September, 1946, to prevent the introduction into Persia of plant diseases and pests prohibits the importation, *inter alia*, of potatoes from foreign countries to exclude wart disease (*Synchytrium endobioticum*); of cuttings, grafts, and rooted plants of citrus and other fruits (except for local consumption and by special permit for propagation) against citrus canker (*Bacterium* [*Xanthomonas*] *citri*) and other diseases of fruit trees; and of wheat, barley, rice, and sorghum for cultivation as a safeguard against *Tilletia horrida*, *Urocystis tritici*, and the like.